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Including SOUTHERN AVIATION and AERONAUTICS

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XUM

Heroes of the Flight Test Unit

by
ALICE ROWAN GILLIM
and
ALDYS SNODDY
of the U. S. Air Corps
Library

U. S. A. Air Corps Photo

Major James T. Hutchison, an early member of the Caterpillar Club.

TO PROGRESS in this world of ours man has always had to pay a price. That price has not only consisted of an expenditure of his time and money, but, it has also consisted, at times, of making an expenditure of life itself.

It is the story of the courageous acts and sacrifices made by the valiant men of the Flight Test Unit of the Army Air Corps, in order that aviation might progress, which we want to tell about in this article.

Back as early as 1917, McCook Field, Dayton, Ohio, and later Wright Field, located in the same city, started this unit in the Air Corps. Here in this flight laboratory many important events in the development of commercial aviation as well as military aviation have come to pass.

The twenty-five or more pilots who have been detailed to the Flight Test Unit of the Flying Branch of the Air Corps, since its organization, have all been outstanding aviators in the history of aviation a selected group whose duties have been to find out just what the Air Corps might expect in performance from its airplanes, and how best to improve the future equipment by profiting by the mistakes of the past. To do this the plane has to be put through many tests; such as spins, dives and acrobatics; for they want to find out just how the craft will stand up by the exigent demands of war.

First among the able pilots who have done much to make aviation what it is today we shall take up Captain Donald L. Bruner, now retired.

After returning from over-seas where he had been called upon to do night flying, by the use of flares to enable him to land, during the World War, he was sent to McCook Field where he became a test pilot. It was while stationed there he thought about the many trials the War time pilot had to contend with in his night flying, and the difficulty he had in making a landing by means of flares.

Some of the men tried to forget it and think of it as a bad dream, but not Captain Bruner. After much thought he figured that if aviation was to be of any great value to the world there would have to be many more flying hours added to the time spent by a pilot in the air. Therefore, he concluded, some means by which the aviator could fly on into the night hours would have to be devised.

His first idea on the subject was to have a reliable landing-light attached to the airplane which would give the pilot a clear view of the ground from some distance above. A high-powered electric light did not exist, so he, with his co-workers, set about to develop such a light.

Major Albert F. Hegenberger, the first army pilot to fly alone with the cockpit covered.

After much detailed investigation a special lamp, built experimentally for motion picture projection work, was obtained. This lamp after many tests and changes rewarded our industrious flyer by its usefulness, and became the landing-light the Army and Night Air Mail was to use. In such a manner were the many lighting facilities for our night flying of today begun.

Credit for this contribution to aviation progress must go to the persistence of Captain Bruner, the Army Test Pilot, who braved the early hazards of night flying in order that the aviators the world over should not have these hazards.

U. S. A. Air Corps Photo

Major St. Clair Street, commander of the Alaskan Flying Expedition.

U. S. A. Air Corps Photo

Lieut. E. H. Barksdale, who was killed while testing an army plane.

U. S. A. Air Corps Photo

Major Frank O. Hunter, a World War Ace, and who later joined the test units.

Have Made Aviation History

U. S. A. Air Corps Photo

Major Hez McClellan, who was recently killed while testing an army plane.

A story the men around the hangars out at Dayton never weary of telling is that of Major James T. Hutchison's parachute jump—one he was forced to make while he was testing a new light bomber which had recently been delivered to the field.

The engineers and designers had considered it the last word in that type of plane, for its laboratory tests showed no tendency toward vibration. However, the various test pilots who had flown it reported this not to be true. They had noticed in the first few flights made by them a decided vibration in the wings and fuselage.

One day Major Hutchison with Mr. Paul Stanley, to act as test observer, took up this newest addition to Uncle Sam's bombing planes for a test flight. They were determined to find out just what was causing the trouble. While they were flying along at an altitude of about 8000 feet noting the intense vibration of the plane, they were suddenly awakened to the fact their airplane was on fire.

Clouds of smoke and flames were reaching toward their faces, which sent them hurrying from the cockpit. After a moment's time both of them were able to climb on the wing. The pilot made a desperate effort to reach into the cockpit to turn off the engine, but the flames proved the victor in the conflict and he was unable to accomplish the act. He was able, however, to throttle it down.

Having done that he called in a determined and cool voice to his passenger, "Jump." Mr. Stanley jumped and cleared the plane, then released his parachute. Then, and only then, did Major Hutchison leave the wing. This proved to be one of the most exciting and dangerous parachute jumps in army history. His chute had no more than opened when he saw he was in direct line of the falling and burning machine, loaded with its deadly bombs. He tried to side-slip the parachute, but to no avail, for the elements were against him.

Down, down, he went for several thousand feet with the exploding and burning plane above him. Fate must not have intended for that to be Major Hutchison's last flight, for gradually the plane's superstructure burned away and dropped about him. Both Major Hutchison and Mr. Stanley landed unhurt. The plane, however, crashed and burned.

The first was caused by a leakage of gasoline from a broken gasoline line, which, coming in contact with the flames from the exhaust, ignited. The break in the gasoline line was due to the vibration they had all been so concerned about. Naturally this error in construction had to be corrected in order that the planes of the future would be safer. And so, the necessity for Major Hutchison's dangerous jump into space was not in vain for he had noted carefully the faults in the machine that must be overcome.

U. S. A. Air Corps Photo

Major R. W. Schroeder, a pioneer in altitude flying. Now with U. S. Dept. of Commerce.

Altitude flying was another phase of aviation that the Air Corps became interested in. There was stationed at McCook Field in 1919 and 1920, a pioneer in this type of flying, a pilot who saw into the future and realized that man would demand the speed in flying that only altitude could give him. That man was Major Rudolph W. Schroeder, Chief Test Pilot at that time. Always interested in aviation, especially the development of flight in the upper air, he devoted most of his experimental work to this phase of it.

The successful culmination of his record

U. S. A. Air Corps Photo

Wilbur Wright Field, Dayton, Ohio, where the U. S. Army Air Corps planes are flight tested. This is the scene of Army Air Corps experimental work.

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flight of 28,500 feet with the Le Pere biplane equipped with a Moss supercharger in 1919 was the result of a long series of well thought out tests. These tests brought about numerous problems which had to be mastered before the real flight could take place.

Some of these difficulties were: the delivery of fuel to the carbureter against its varying pressure; cooling at high altitude and raising the boiling point of the water; and the problem of providing a drain valve to let the water out of the radiator at high altitude in case the engine stopped, so that the engine and cooling system would not be ruined by the water freezing, and at the same time, it was necessary for this valve to be arranged so that it would not itself freeze, thus making it possible to operate it.

Major Schroeder had also to invent and design special goggles which would not freeze over in the intense cold at great heights, as well as, an instrument to show the pilot how to control the supercharger pressure in his carbureters without the need of making calculations.

Fortunate was the Engineering Division to have with them such a man as Major Schroeder for these supercharger tests, for he was not only a good pilot, but an able engineer and mechanic—in fact, he knew his airplane.

The supercharger worked well throughout this history making flight but the oxygen feed apparatus failed him and he had to resort to his emergency tanks of oxygen. Probably due to the large amount of exhaust gas he breathed, Major Schroeder had to use an excess amount of oxygen, thus using up his reserve supply sooner than he had anticipated. The result was, he lapsed into unconsciousness, due to the poison from the gas, rather than the lack of oxygen.

When his oxygen gave out he raised his goggles to see more clearly and to attempt to obtain some more oxygen from another tank. At that moment unconsciousness overtook him, but not before he had the presence of mind to reach his switch and put the machine into a spiral. The plane tumbled like a shot pigeon down to about

U. S. A. Air Corps Photo

Capt. Donald L. Bruner, retired, whose pioneering work with landing lights led to night flying.

U. S. A. Air Corps Photo

Major John A. Macready, one of the Army's outstanding pilots.

3000 feet when Major Schroeder regained consciousness, righted the plane and landed, still in a semi-conscious state with his eyeballs frozen.

This is truly a heroic story of the air. A story of a courageous man willing, if necessary, to sacrifice himself in order that the thing he believed in would go forward.

The test pilots at Dayton have a conference every morning at which each one of them makes a report of his experiences of the previous day. One summer morning in 1927 at one of these conferences the men reported that upon throwing one of their new observation planes into a spin, the spin developed into a strange flat variety, far different from anything they had ever experienced and most difficult to pull out of. This caused considerable dismay at the meeting for the plane was thought to be a decided step forward over other models of this type.

As no test pilot is ever called on to make a flight his chief would not make, Lieutenant E. H. Barksdale, then in charge of the test unit, decided he would take this machine into the air and see if he could find out, why its peculiar behavior.

After the plane had climbed to an altitude of 6000 feet, he pulled the nose of the ship up into a stall, kicked on right rudder, and let it go. The strange spin developed, as reported by the two pilots who had flown it previously, and the plane came down to about 2000 feet before the pilot was able to level it out.

He attempted to climb again, in order to try the plane out in a left spin, but this time it became uncontrollable, and Lieutenant Barksdale knew that he would have to bail out. The spin had become a thing of wild speed, and in trying to leave the machine he was thrown with great force against the wing brace-wires which cut the cords of his parachute, letting him fall free to the ground. And so, one of the Air Corps most able and valiant pilots paid with his life for the advancement of aeronautical science.

Next morning at the Round-table it was hard indeed for Lieutenant Barksdale's fellow-workers to go on. At first they sat in silence and looked with grief stricken faces at the empty chair before them. Then one

(*Continued on page 62*)

New French Aviation Engines

THE general trend of development of radial, air cooled aviation engines toward the twin row type, in order to obtain increased power with decreased "drag" (head resistance) has made rapid progress during the past year.

Up to the present time fourteen has been the maximum number of cylinders, used by all the constructors, to equip this class of motors. The Gnome & Rhone Co. has now, however, developed and presented a new twin row, 18 cylinder, radial, air-cooled, supercharged geared engine, which marks another forward step in the construction of this type of power plants.

This new Gnome & Rhone 18 cylinder twin row engine, which has just been "homologued" (approved and passed) by the Service Technique is but a first model. It is lightly super-charged and runs at a low RPM, which shows that a considerably increased power can be obtained when the super-charging and RPM used are made similar to those now being employed in other motors of this type.

THE GENERAL CHARACTERISTICS ARE AS FOLLOWS

Bore: 146 m/m (5,75 inches).
Stroke: 180 m/m (7,1 inches).
Cylinder Displacement: 54,24 liters (3314 cu. inches).
Compression Ratio: 5,5:1—Rated RPM. (Speed) 2,150.
Critical Altitude: 1,600 meters (5,250 feet).
Airscrew gear reduction ratio: 13:19—Rated RPM of Airscrew 1470.

POWER DEVELOPED ON TEST BENCH

Rated Power (sea level): 1220 HP.
Pressure in Intake Manifold (at Rated Power, sea level): 877 m/m (34,5) inches) HG (mercury).
(A Boost Pressure of 117 m/m (4,60 inches) HG equivalent to 2,27 lbs. per sq. inch).
Power at Critical Altitude: (1,600 meters) 5,250 ft.: 1,300 HP.
Maximum Power permitted at sea level for "take off": 1,400 HP.
Maximum Power developed at sea level: 1,580 HP.
Pressure in Intake Manifold (maximum power sea level): 948 m/m (37,25 inches) HG.
(A Boost Pressure of 7,38 inches (188 m/m) HG equivalent to 3,64 lbs. per sq. inch).

POWER IN FLIGHT

Rated Power in Flight: 1,360 HP at 2800 meters (9,200 ft.).

WEIGHT OF ENGINE

Total Weight (Carburetor, magnetos, and spark plugs inc.): 736 Kgs. (1624 lbs.).
Weight per HP (at maximum power developed): 465 grams (1,025 lbs.).
Frontal Diameter of Engine: 1,41 meter (4 ft. 7 inch.).

The Cylinders are manufactured in two parts.

1. A steel barrel in which the piston functions.
2. A Cylinder head manufactured of

(*Concluded on page 63*)

XUM

Experiences at the South Pole

A highly interesting account of a heretofore unpublished phase of Admiral Byrd's trip to the Antarctic.

by J. A. PELTER

As told to LIEUT. C. ADAIR

THE instructions on a package of aerial film say, "Keep on ice until ready for use . . . then take off and leave for 24 hours in ordinary room temperatures."

At Little America this type of film or any type of film can't very well be taken off ice; there is no place to put it back, except on ice. All storerooms are holes cut in ice. All Little America is ice; a ledge of ice and snow—no soil beneath it.

Thus, it can be seen there were no ordinary room temperatures at Little America. But pictures were taken, developed, and printed just the same—many thousands of them. The story behind this work is an interesting story of adventure in photography.

The extremely low temperatures encountered at Little America produced unique conditions for photography. Some of the problems were similar to those of any winter photographer. I had experienced some of them before myself, but Little America showed me some brand new ones. It really had me scratching my head—that is, I would have scratched my head if it hadn't been for the fur lined glove which I needed to leave on for protection against the cold. I took many pictures in temperatures of 60 degrees or more below zero.

Sometimes, when all was ready except the setting of the diaphragm opening, I would quickly remove one glove. It would be so cold that my finger would stick to the metal of the camera. Just before each photograph I also had to take off my glove to pull the slide out of the plate holder, and to put it back into the holder again. This would make my hand stiff and clumsy. The heavy arctic clothes made all movements laborious and slow.

Other factors, which I shall touch upon later, had further to do with slowing down the photographic routine, especially on the extremely cold occasions when I felt like getting the job over with quickly and seeking shelter.

Nice and comfortable in the aviation work shop in Little America, even though the outside temperature is far below zero.

It was a little warmer inside the tunnels and rooms, even though they were carved from the snow and ice fifteen to twenty feet below the surface, so in this account I shall tell of some of the inside pictures that I made—interior shots, as they are called.

Later, as the reader becomes gradually accustomed to the icy weather, I shall take him to the surface for some outside shots. By this time, he should be hardened sufficiently for the aerial shots from the big Curtis "Condor" plane.

Of the several thousand photographs which I made while on the Second Byrd Antarctic Expedition to Little America, about 700 were interior shots. I used an 8-inch by 10-inch Eastman camera with an extreme wide angle lens, with focal length about nine inches. This was necessary because of the smallness of the rooms.

Photo-flashes and photo-flood-lights had to be used on all of the indoor shots. The task of lighting up rooms and the men in rooms at Little America for a photograph required by far the most effort and study of any part of the picture that was being made. This is true of any interior picture and, in general, the more time and effort spent, the better will be the result.

An indoor shot of a group of people at Little America, however, is an art in itself. Some of these pictures took me three hours each. The first hour was using for thawing out the motor of the portable Westinghouse generator. This generator was needed for extra power when the photo-flood lamps were hooked into the main power line.

It was necessary to bake the motor in an oven for an hour before attempting to start it. After this came the starting of the motor. It would take anywhere from a few minutes to an hour to accomplish this. Electric leads had to be brought in and lamps screwed into place. The hardest part of the

Admiral Byrd (left) has a steady nerve and can stand motionless, hence the perfectly sharp head and shoulders of the Admiral.

XUM

whole picture would be the getting together of a group of busy men.

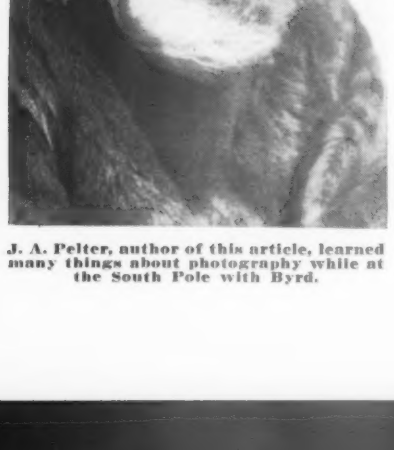
Everybody worked hard all of the time —most of us, 16 hours a day—and this accounts for 56 men in a confined space getting along without any trouble whatever for two years. If a picture was to be taken it meant leaving important work—consequently I tried to take as little time as possible for the photograph after the men were in their places.

If something happened to a generator or if any other trouble held up the photograph, by the time I could remedy the trouble and get back to the camera there would be no one left in position. This happened a number of times during the expedition. No matter who was responsible for the trouble, the photographer always got the blame.

In making interior shots, I always used a light exposure meter—a Weston. I was able to get satisfactory results on about 95 per cent of the interior shots and this can be attributed largely to the use of this instrument. They are useful for many types of pictures, but for the interior shots at Little America I would say that they were indispensable. It is harder to judge the amount of light inside a room than it is to judge the light out of doors. The main power line supplying current for the photo-flood lights fluctuated—sometimes as much as 50 per cent. To the eye, the change would not be noticed, but the light meter readily detected it.

I used 12 or 15 photo-flood lamps on each exposure, especially in a large room with people in it. Here, it would be necessary to use a deep stop, that is, a small diaphragm opening, in order to get the desired depth of focus, and, of course, the smaller the diaphragm opening, the more lights that would be needed and still make the exposure short enough to keep the people in it from blurring the picture. I used one-fifth of a second at stop 32 in most cases. If there was no life in the setting,

(*Continued on page* 65)



J. A. Pelter, author of this article, learned many things about photography while at the South Pole with Byrd.

At Last—The One Bladed Propeller

by M. A. RODDY

It's the latest in aeronautical gadgets, this one-bladed prop. To W. W. Everts, inventor of the Everel propeller, goes much credit, for the prop is supposed to make the small Cub perform much more ably than ever.

SOMETHING revolutionary in the way of propellers was demonstrated at Curtiss-Reynolds airport, Glenview, Ill., by Lieut. Arthur Seger Peirce, when he made test hops with a Taylor Cub powered with a one-bladed prop.

These flights were part of a 3,000 mile experimental trip by Lieut. Peirce from the factory at Bradford, Pa., to the west coast, where the new device was to be placed on exhibition during the Pacific Aircraft Show.

Veteran pilots were astonished at the performance of the abbreviated stick, which is credited with stepping up the speed of Cub "flivverplanes" by 25 percent. The rate of climb is increased one-third and the take-off run decreased 50 percent. In addition, it is claimed that the one-half propeller completely eliminates vibration and gyroscopic action.

The new blade is known as the Everel Propeller and was invented by W. W. Everts, Baltimore engineer, who has been working on propeller design for eight years. Six years ago, he patented a variable-pitch propeller with spring action. Four years ago he dropped that, to bring out a variable-pitch prop with manual control, and two years ago patented one, which was automatic with constant speed.

Evert's one-sided air-screw was patented last May and put through a series of exhaustive wind-tunnel tests.

According to Lieut. Peirce, the single-blade eliminates the "burble" created by conventional propellers. The leading blade of a standard prop cuts through the undisturbed air, exerting maximum tractive power. The blade which follows causes a disturbed condition of the air, lowering efficiency.

Regarding the new device, the single blade is set in a hub, and where the balancing blade should extend, its place is taken by a metal counterweight.

At the field it was pointed out that a prop which has lost half its blade or been thrown out of balance can tear a motor out of its mounting, and the single-blade was regarded as an improvement. However, Evert's invention to date has been used only on small planes. Wind tunnel tests are being conducted on larger craft.

The Everel propeller would appear to the uninitiated to be nothing more than a ball-bearing hub with one blade. The lone, counter-balanced blade can be twisted to a certain degree in any direction.

Main claims for the new propeller are that it practically eliminates vibration, increases the performance immeasurably and has been flown dozens of times to prove it.

Lieut. Peirce now is touring the United States in the interest of both the Taylor Aircraft Corp., and the propeller company. To date, according to Lieut. Peirce, the new propeller has performed at a slightly better all-round advantage over the conventional propeller.

The cross-country tour now being made by Lieut. Peirce from the Taylor factory at Bradford, Pa., to Los Angeles, Cal., is serving as an actual operations "test tube" for the new propeller.

Sensenich Brothers, of Lititz, Pa., who manufacture all propellers for the Cub, will handle the Everel propeller.

Several years ago the Sensenich brothers started manufacturing propellers in a stone barn on their farm, and despite the fact they have turned out over 2,000 Cub props, they are still using the old stone building. From an original crew of two their staff has grown to two score and the stone barn is crowded with machinery.

Two Noted British Lightplanes

by BERT D. LYNN

American amateurs and private plane owners will be much interested in the two extreme types of lightplanes shown here. One is the choice of Col. Lindbergh.

HAILED by its makers as aviation's most unusual craft of its type, a new lightplane, the "B.A.C. Super Drone," is now available to British fans. This sensational little job is manufactured by B.A.C. Ltd., at the London Air Park in Middlesex.

The Super Drone last summer, while still in an experimental stage, broke the World's Long Distance Record for Ultra-Light Aircraft by flying non-stop London to Berlin, 600 miles in 11 hours, and back to London in 9 hours. This flight was made by Lord Sempill. He was received at Tempelhof airdrome by the famous war-time flyer, Ernst Udet.

The craft is a single-seater high-wing open-cockpit pusher monoplane fitted with a 19 B.H.P. Douglas engine. It is the design of Robert Kronfeld, who threw his wide experience in gliding and soaring into the development of a British ultra-light aircraft which would be both a true glider and a powered plane.

It is the first aircraft in England to be allowed to fly without a Certificate of Airworthiness. Among the qualities attributed to the Super Drone are: the most complete field of view of any plane, the shortest takeoff and landing run and lowest landing speed of any plane made, the greatest degree of safety and ease of flying seen in any British light craft.

"This machine will actually stay in the air at quarter throttle without losing height. The controls are harmonious and sensitive and the Super Drone may be banked steeply, brought down on even keel at or beyond what would normally be a stall, side-slipped, flat-turned indefinitely, and flown slowly with half-throttle and the tail far below the wheels, though only a few feet above the ground, without risk.

"It can even be firmly stalled about twenty feet from the grass with the motor off, and a recovery and another stall and another recovery may be made before alighting like thistledown." So we are informed by Captain Collins, writing in *The Aeroplane*.

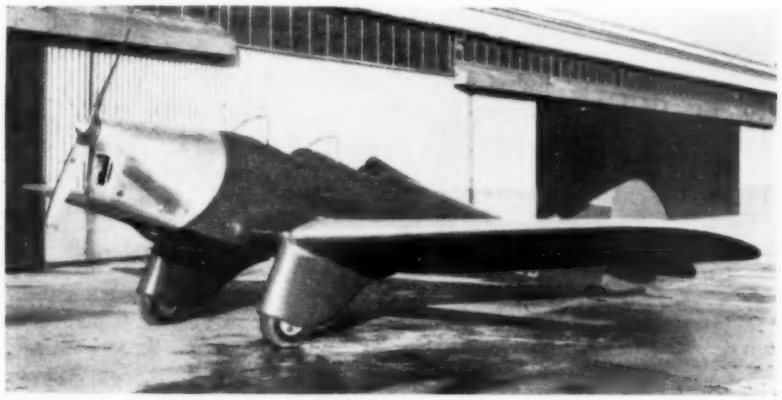
We are also reliably told that the wife of the designer of this craft had a few lessons in gliding, during which she was in the air for a total time of not over six minutes and she then flew the Super Drone perfectly!

Good weather for the Super Drone is quite a different thing from good weather for most machines. Good enough for Drone flying is any day of more than 500 yards visibility.

The wings fold by means of an auxiliary spar which carries the rear-spar root hinges out some distance from the center section. A jury strut supports the leading edge root when the wing folds back. Unusually long ailerons improve the aileron control.

Exceptional economy is claimed for the plane. It can be flown for 2 shillings from London to Portsmouth, one hour's flight. The annual cost of operation, for 200 hours' flying time, is estimated at $250.

Among the included equipment are Goodyear Air Wheels, celluloid windscreen, castoring rubber tail wheel, safety engine starter, spacious luggage compartment, and all necessary flying instruments.



This Miles "Hawk Major" is the English equivalent of two American low-wing jobs that have achieved eminence in this country.

SPECIFICATIONS

B.A.C. Super Drone
750 c.c. Douglas Engine

Landing Speed	22 m.p.h.
Cruising Speed	60 m.p.h.
Climb	380 ft./min.
Service Ceiling	12,500 ft.
Take-off and Landing Run	45 yards
Fuel Consumption	1.25 g.p.h.
Tare Weight	390 lbs.
Total Weight	640 lbs.
Span	39 ft. 8 in.
Length	21 ft. 2 in.
Height	7 ft.
Wing Loading	3.7 lbs./sq. ft.

Another fine British light plane, a more substantial job than the "Drone," is the Miles "Hawk Major," the civil version of the Trainer which is the only monoplane officially approved by the Air Ministry for *ab initio* training of Royal Air Force pilots.

The "Hawk Major," holder of the England to Australia Light Aircraft Record, is offered to the private owner who requires a machine of high performance and yet retains the safety and economy of a slower plane. It is built by Phillips & Powis Aircraft Ltd.

A low-wing monoplane with dual controls, it has wooden wings and fuselage, ply-covered. Construction features are hydraulic split trailing edge flaps, Bendix wheel brakes, single-strut undercarriage, luggage locker, and leather-upholstered cockpits. The engine is a 130 h.p. "Gipsy Major."

(*Continued on page 66*)

The B.A.C. "Super-Drone" is an example of a true amateur type single-place job that has attracted much attention.

The Waterman "Arrowbile" Is Demonstrated

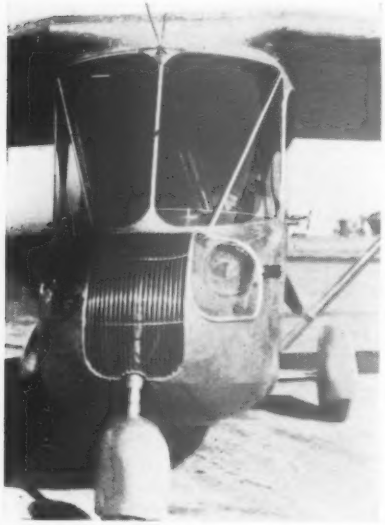
by G. B. BURTNETT

This is a side elevation of the Waterman "Arrowbile" chassis, showing the disposition of the powerplant and the unusual good visual range.

SOLVING the problem of inaccessibility of landing fields to business and residential districts, while supplying at the same time a combination automobile and airplane that is economical and safe to fly is the claim made for Waldo D. Waterman's Arrowbile demonstrated in February at Santa Monica, California.

Wings that can be detached or attached in three minutes convert a streamlined coupe into a ship that will cruise at 105 miles an hour. The top speed in the air is 120 miles per hour and on the ground 70 miles per hour. Gasoline consumption at cruising speed in the air or at 50 miles an hour on the ground is one gallon to sixteen miles and ordinary gasoline is used.

The power plant is a standard Studebaker automobile engine, water cooled. Six vee-type belts are used to drive the propeller and a simple de-clutching device powers a drive shaft to the rear wheels for ground use. . The engine develops 100 horsepower and costs but 15 per cent of the usual aviation engine of equal power.



The front end of the Waterman greatly resembles the hood of a car.

The only wood used in construction is in wing spars. The wing has a metal leading edge, the balance being cloth covered for light weight and low cost construction. Everything else is of metal, duralumin. Automobile instruments are used; the tires are those used on "midget" racing cars.

Because bad weather restricts travel in private planes the Arrowbile is equipped to carry its wings when used as an automobile until an area is reached when flying can be safely resumed.

Safety claims for the ship are that it cannot spin; cannot stall; will take off by itself without the use of hands; flies hands off; requires only a short takeoff or landing area. The cruising range is 400 miles on the 26 gallon gasoline tank. It is 19 feet long and has a wing span of 38 feet. It weighs 1635 pounds empty, 2200 pounds loaded. It will climb 700 feet per minute at sea level.

The ship can be serviced at any neighborhood gasoline station. Wings are removed on a special ramp and hoisted to hangar roofs for storage. Airport managers say they will store them for $5 per month. Usual hangar cost for standard planes is $25 per month or more.

Absence of fuselage or tail makes the maneuverability of the auto body easy in traffic and gives greater visibility in the air. Rudders are located at each wing tip. Ailerons function as both elevators and ailerons.

The accompanying front view and side view show the excellent range of vision, down, to the rear and forward. Visibility is one of the most important features of a plane intended for the amateur.

Commercial production of the ships will supply them in the fall and the cost will be about $1200 when 10,000 units have been manufactured.

New Take-Off Method

IT IS claimed that gigantic air boats and other heavy aircraft are to have their cruising radius doubled and payloads increased more than 30 percent, by means of a launching device recently tested in San Diego.

A biplane weighing 1700 pounds, with a 28-foot wing spread, was mounted on a hand-car, six feet wide by eight feet long, equipped with an automatic brake to stop it as soon as the plane rose from the platform.

As the chocks were pulled, the engine started and, drawn by the propeller, the plane and car rushed down the railway track. When it had attained a 60-mile speed, only 300 feet from the starting point, the pilot pulled back the stick raising the elevators; the biplane literally jumped from the car.

After the successful experiment, a public statement was issued, listing the following as some of the advantages:

Take-offs with heavier loads than by the conventional practices.

Winter take-offs when water, ice, and snow obstruct the flying-field.

Permits landplanes to take off with retracted, or removed, landing gears.

Permits seaplanes to take off with wing-tip floats retracted or removed, increasing efficiency.

Permits wing-tip floats of a smaller size than required under conventional take-off conditions with heavy load.

Eliminates spray sometimes striking the propeller and tail surfaces.

Eliminates hull pounding usually experienced in taking off heavily loaded air boats from the surface of the water.

Safer take-offs at night, in dense fogs, or in heavy snow storms, because it would be unnecessary for the pilot to steer the plane on a narrow runway or in a water channel.

Safe blind take-offs because the track guides the plane in the run and no-lift longitudinal attitude of the plane is maintained up to the moment the pilot takes off.

No night illumination necessary. This factor would be particularly advantageous under war conditions.

These and so many more advantages are assured that the experimenters decided at once to install this launching device with refinements in a local landing field for commercial use.

Flying Crime Lab

HAVING made considerable progress in the apprehension of criminals through the use of radio-equipped motorcycles, automobiles and the teletype, the Massachusetts Department of Public Safety, popularly known as the "state police" is now planning to add a "flying crime laboratory" to its equipment.

Commissioner Paul G. Kirk says that his department will spend $13,952 for an airplane, which will be outfitted with many crime detective devices, including photographic and finger-printing equipment. The plane will be kept at the East Boston airport and will be manned by state police pilots. It will also have a two-way radio.

They Laughed, Flew and Died

by WILLIAM L. HOPSON

Another of Mr. Hopson's excellent stories of the old cow pasture days when men were men and everybody took a chance. Hard fighting—hard flying and hard drinking were these heroes of early aviation.

THE huge crowd had waited for hours, many of them since daylight. Now, at last, a monoplane—a big bellied, heavily loaded cabin job—trundled slowly down to the end of the field. There was a hushed moment of tense expectancy as the pilot tested rudder and ailerons, gunned the motor a bit. Then the aircooled Wright Whirlwind broke into a roar, the tail came up, and the plane lumbered down the long length of the runway.

Almost at the end it lifted, fighting with every ounce of its bellowing two hundred and twenty-five horsepower to gain altitude. With throttle open it banked ever so gently, gained speed and vanished into the mist, flying West. It was soon followed by another—and still others.

The Dole Flight to Honolulu was under way.

No—not quite. A part of the crowd had stayed on, as crowds will, and presently was rewarded by sight of a tiny speck winging back out of the mists hanging low over the Pacific. The speck grew larger and took shape and the plane banked gently, its missing motor subsiding into a throaty splutter as the pilot cut the throttle and came in for a landing.

White clad mechanics swarmed over the engine; someone came running with new spark plugs; the pilot, a slender built, sandy haired chap, waited. Presently the motor broke into a smooth roar, the pilot waved and was gone into the mists again.

Young Auggie Pedler carrying Mildred Doran and a navigator was trying hard to catch up.

TIME rolls back a few years. Two of us were working on the tail skid of our "Jenny" one morning at a cow pasture flying field on the outskirts of a small town when out of nowhere there came the drone of a ship.

A speck winged out of the north and presently an ancient single seater Tommy Morse Scout banked over the field, its 120 horsepower motor—God! how those old French built rotaries could sling dirty castor oil!—missing.

The motor subsided into a throaty splutter as the pilot cut the gun and came in for a landing. We saw then that the single seater was carrying *two* passengers, one in the knot-hole cockpit. The other lay stretched out face down on top of the fuselage directly behind the propeller and hung on to the wing struts.

The pilot taxied over and cut the gun and the passenger, a slightly built, sandy haired chap, slid down from his precarious position. He mopped his oil spattered face with a handkerchief and grinned. The other fellow cut the switches and crawled out, and while they cleaned fouled spark plugs we all exchanged flying gossip. A little later the motor broke into a smooth roar and presently the pilot, the slightly built, sandy haired chap, waved and was gone again with the other fellow lying astraddle of the oily fuselage.

Auggie Pedler and another barnstormer were going—where?

THEY were a strange brotherhood, those old-time barnstormers. Hard drinking, hard fighting, hard flying. As nomadic as a Gypsy at heart, as roguish as a schoolboy, and devil-may-care enough to have flown a barndoor had a motor been clamped to it.

And here is the author, William L. Hopson, all dressed up for a jump through the little green door.

They flew other ships besides the Tommies, too: flat winged, narrow bellied, long tailed Curtiss Jennies with their powerful 90 horsepower 0X5 motor—"the most swore at and swore by motor ever built"; long winged "Canucks," the Canadian version of the Jenny; and Standards, big fellows with their mighty 180 horsepower Hispano-Suiza "Hisso" motors and room for four passengers in the open front pit. The pilot sat directly behind.

It was in these jobs that the vagabonds flew from town to town, carrying passengers at a dollar a minute; looping and barrel rolling and diving. It was in these jobs that they roared under bridges and telephone wires; rolled the wheels over flat barn roofs at ninety miles per hour; scattered chickens and cows and sheep in panicky flight.

It was in these jobs that the parachute jumper went up to do *his* part—with an ancient type, and in many cases homemade, chute which instead of being strapped to his body lay in a canvas bag on the wing alongside the fuselage. Many of them used only a rope sling for harness, their weight jerking the folded chute from the bag when they jumped off the wing.

And it was in these jobs that Dutch flew.

We had just taxied in between the iron stakes that late summer evening and were tying down the ship for the night when the fellow blew in on foot with one of the early model Russel pack chutes slung over one shoulder. Said he was a jumper, had just bought the chute at the factory in San Diego, and wanted to pull off a jump. A delayed drop of several hundred feet, which was quite a novelty at that time. Said he was the Smiling Eagle—and had a much folded handbill to prove it.

Dutch took him on, my own chute being temporarily out of commission. I'd bailed out in a stiff wind a couple of days before, landed in a barbed wire fence on a golf course and torn hell out of three panels of my chute—and about two panels out of the seat of my pants. A lady friend was sewing in some new ones. In the chute, I mean. This was Saturday.

Twenty miles across country from the field that we were working from temporarily was a prosperous farming community that we'd worked before. The citizens had liked the show we'd put on; had proved it by pitching thirty-eight dollars and some odd cents into a hat to see me jump and to see Dutch do his bag of tricks with the Jenny; and had asked us to come back.

So, the next day being Sunday, the three of us flew over. Having changed the controls and instruments—what few there were—into the front cockpit a few days before, Dutch flew the ship from the front cockpit; I sat in the back, the Smiling Eagle sat on my lap and carried his new chute in his lap. All in all the old Jenny had a pretty good load.

Our appearance over town, circling around and around to be sure everybody could see us, was the signal for all to come flocking, and a half hour later business was flourishing. I'd take five dollars and help a passenger into the front cockpit and Dutch would gun the OX5 and go lumbering off across the pasture. Five minutes later the passenger, oil spattered and with hair rumpled, would be helped out, another helped in, and five dollars more collected. We never used a helmet unless they asked for it. Took too much time to put it on.

All this time the Smiling Eagle wandered aimlessly about in a pair of shiny new field boots and modestly explained to several hot looking rustic violets that there really was nothing to it. You simply strapped on your chute, went up and bailed out—what! Just like that. Did he lose consciousness or his breath while plummeting through space? Ha! Of course not!

Four o'clock and time for the Smiling Eagle to go up and make his one thousand foot delayed drop came all too soon. Too

XUM

soon the way business was. With hands that shook slightly, the Eagle, who wasn't smiling now, slipped into his chute harness and snapped the buckles under his crotch and across his belly. I gave him a hand, having already taken up the collection in a helmet. No matter what happened now, we were at least partially financed and that was something to cheer up anyone in these days.

We went over to the ship and I boosted him into the rear pit. Dutch gunned the OX5, waddled the Jenny off across the pasture in a streak of dust, and finally booted her into the ozone with a very nervous jumper sitting uncomfortably behind him. He leveled off at three-thousand, cut the gun, turned around and bawled at the top of his lungs: "All right—let her go!"

But something had happened to the Unsmiling Eagle. He poked his helmeted and goggled head over the side and took one glance at Mother Earth far, far below; at the fields and pastures which were but irregular patches of green and brown; at the long line of cars which were but a thin black mark around the field nearly a mile below the outspread wings of the ship, and gave an emphatic shake of the head.

It mattered not to him that the people down there had donated liberally to see him jump—that he'd have to face their scorn and pay back their money upon landing. To Dutch's profane roars he only sat tight and shook his head, pointing a shaky hand down.

Unfortunately for the Eagle, Dutch was a fellow who took his public seriously. He opened the throttle again and began swinging in easy circles above the field, hoping the Eagle would get back his lost nerve. After five minutes he cut the gun and half turned in the cockpit. The Eagle still sat tight, pointing down.

"Why not stand up and see if you can't make it?" Dutch bellowed in a pleading voice. "You can't go back on those people down there. They've pitched in to see you jump. I believe you can make it."

The Unsmiling Eagle was dubious. However, in answer to Dutch's entreaties he rose to his feet gripping the padded rim of the cockpit, started to sit down again—hurriedly. Too late! The old OX5 gave a roar as the throttle shot open, Dutch slammed over hard on the stick, and the Jenny whipped through a wild barrel roll. There was a flurry of arms and legs from behind, a startled squawk, and the Eagle sailed gracefully end over end out into space clutching frantically at the edge of the cockpit, which wasn't by sixty feet within reach of his flailing arms.

For five hundred feet he somersaulted earthward, clawing wildly at the rip-cord ring on his left side. Then he found it and a flash of white silk billowed out, snapping him upright with a jerk. Down below the crowd broke into cheers. Here was a chute jumper who really put on a show!

They continued to cheer and honk automobile horns while the big white, lobe shaped umbrella floated its burden to earth.

The hero thumped into the ground about a hundred yards from where the placid Dutch sat waiting for the excitement to subside so he could get back to hopping passengers. And unfortunately for Dutch,

(*Concluded on page* 56)

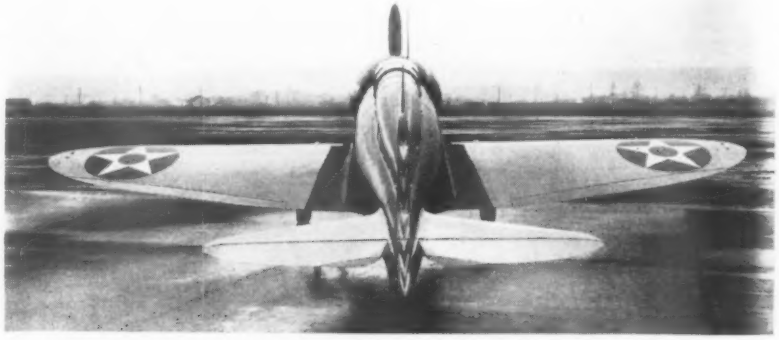
The Boeing YP-29 Single-Seat Pursuit Plane (See front cover)

Side elevation of the Boeing YP-29 Pursuit plane.

THE Boeing YP-29 is a single-seater pursuit plane manufactured at the Boeing Aircraft Company in Seattle, Washington for the U. S. Army Air Corps. Three of these airplanes were purchased for experimental purposes.

This accounts for the fact that none of them has ever been assigned to a Squadron. As yet the YP-29 has never been adopted as standard equipment in the Air Corps.

This "High Speed Pursuit" Boeing YP-29 is a low-wing monoplane with full cantilever wing and tail surface construction and with enclosed cockpit. It is powered by a Pratt & Whitney Wasp with fuel charger, rated at 600 H.P. at 2200 R.P.M. at 10,000 feet. This ship is shown in its proper colors on the front cover.



The clean lines of the Boeing YP-29 viewed from the rear.

Aircraft Compasses and Their Errors

A MAGNETIC compass surrounded by the unsatisfactory conditions found in service on aircraft is at best working under great disadvantages. Depending as it does on the relatively weak horizontal component of the earth's field for its action, it is not endowed with a positive actuating force. Coupled with this disadvantage, it has the disturbing influences presented by the uncertain and more or less variable magnetic fields set up by the power plant and its auxiliaries.

The most promising substitute for the magnetic compass is the gyroscopic compass, its chief advantage being its independence of the earth's field and the disturbing fields of the aircraft itself. On the other hand it is larger and heavier than the magnetic compass and more costly to build. It is of complicated design.

In the various types now in use aboard ship, the gyroscopic system is not neutrally balanced, use being made of the gravitational couple to keep it precessing into the meridian. The system is consequently subject to disturbing forces whenever accelerations are present as in aircraft, which forces persist for some time after the acceleration has ceased. These errors so far have proven a formidable difficulty in the development of a successful aircraft gyro compass.

The advent of the successful aircraft gyro compass will solve one of the major problems of aeronautical instruments and add to the accuracy of aerial navigation. This will be in line with the growing tendency to have the plane self-contained in all respects as regards bad weather flying. When, and only when, a plane can take off, fly accurately to its destination and land without any information and aid from the ground will the problem of bad weather flying be completely solved.

Airplanes in the Flood Area

by R. A. COOPER

Airplanes helped in the flood relief and were exceedingly effective because they were independent of river or road conditions. Planes have proved to be invaluable aids ever since the Dayton, Ohio, flood many years ago.

THE airplane has again proven its worth! Not as a means of destruction, but as a means of averting destruction, of human life! Planes of the Arkansas National Guard were the eyes of Colonel Elgan C. Robertson in rescuing persons and live stock in the flood area composed of four Eastern Arkansas counties, in this, its latest flood.

As the writer sat in the office of Colonel Robertson at Marianna, Arkansas, and talked with him of the flood and rescue work carried on, the whole situation with its vast possibilities of destruction in the territory flooded loomed as one of the greatest potential disasters in the history of the country. Yet it has been handled with such dispatch that Camp Barton has been hailed as the most efficiently handled camp in the country.

Its record with the other camps in the area, is, not one life lost among the men doing the rescue work, or the people being rescued. The loss of three mules due to the overturning of a truck on a highway is the one loss in the whole area under the control of Colonel Robertson in the martial law zone.

An evacuation plan drawn by Colonel Robertson after the flood of 1927 was followed. Except for a change of three or four persons on the committees named at that time, the ten year old plan was carried out. Each committee functioned when called upon and an army of rescue workers went into action to handle the situation, when the warning came. Headquarters for the area were set up at Camp Barton, in Phillips County, with sub-headquarters at Marianna, in Lee County.

An effective means of locating stranded people in the overflow area was worked out in conjunction with officers of the 154th Observation Squadron of the Arkansas National Guard. An area map of the entire district was used. The area was divided into grids four miles square imposed on the map. Grids were numbered for identification purposes only.

These refugees were spotted by the 154th Observation Squadron, Arkansas National Guard. They were rescued by the small barge shown in the yards of the Miller Lumber Co., Marianna, Lee County.

Every aviator had a map of the area in his cockpit. Planes were brought into the area by radio. They based at Little Rock, at the Observation Squadron Field and upon receipt of request by radio were in the area to be patrolled in forty minutes. This kind of message would be sent by the aviators: "Family, three head of live stock, five hogs, northeast corner, section fifty-nine, Lee County. Immediately upon receipt of the radio, refugees were rescued by barges and sent into refugee camps."

The plan was further developed to the point where the aviator after sending his message by radio would use a wooden block, around which a message was fastened. The block was placed in a cloth and the aviator would then fly over any boat he could find in or near the vicinity and drop the message in the boat or near it. Pilots flew as low as twenty-five feet above the water to drop their messages.

When it became necessary for a personal conference between the commanding officer and a pilot, a radio message brought the pilot to the flying field at West Helena where a car was dispatched to take him to headquarters at Camp Barton. Colonel Robertson made at least four trips over the area under his jurisdiction by plane. Inspection from the air showed him conditions he could not see otherwise.

No doubt the reader is wondering how the people were brought out after the planes spotted them and gave their reports. Small boats were located at strategic points for the purpose of getting the people clear of their homes. These small boats met larger boats and barges at designated places where they unloaded their cargo and returned for other marooned persons and stock. The barges were in turn held until loaded, along levees or in deep water.

When loaded with persons and their belongings they were towed to the nearest spot possible to reach, to disembark for refugee camps. In the Lee County area, barges were tied up at the outskirts of Marianna, where trucks met them and transported them to the camps around the city.

In the Phillips, Monroe and Desha Coun-

U. S. A. Air Corps Photo

No, this is not a submarine base. It is Lunken Airport, Cincinnati, Ohio, under a considerable head of water.

ties area, the small boats took the marooned from their homes, as in Lee County; transported them to levees or other designated places where they met Coast Guard, river boats or barges to be transferred. Twelve Coast Guard boats from the Gulf of Mexico worked in this area. All of them were equipped with radios which made contact with them easy and kept the centrally located headquarters in touch with each.

Elaine, Arkansas, was the disembarkation point for most of those in this southern area. There, army trucks met the refugees and transported them to Camp Barton, the central camp of the entire area. About fifteen hundred persons with their belongings were moved out of the lowlands of Phillips County in boats. Other refugees moved out on their own initiative, or with the help of army trucks manned by National Guardsmen. Camp Barton, at its greatest extent, was a tent city of around twelve to fifteen thousand people, white and black.

Colonel Robertson was especially appreciative of the work of the Coast Guard boats. They did most of their work along the levees picking up those who had taken refuge there. They would pick up a load, radio to headquarters their probable hour of arrival at Helena, then proceed. At the designated hour, army trucks were dispatched to meet them and transport them to Camp Barton, ten miles away.

Some of those rescued would no doubt have been lost had it not been for the work of the army planes which were able to fly low over the water and spot people marooned in trees, on roofs or even in attics. During the work, at its most rushed hours, a plane would fly low, locate the marooned and give a report as to how long they could remain before they must be taken out. A record would be made of the report and then at the latest hour possible, the endangered would be removed to safety.

One aged negro offered a decided contrast to the usual run of marooned when rescuers found him. Planes reported what appeared to be a small camp on the water's surface, so boats were dispatched to investigate and take proper steps. When the boats reached the place, they found several log rafts tied to trees with large ropes, tied well above the water level.

The old negro was the only living person found around the rafts. He had one raft larger than the others, made of large logs, with boards laid on top until a good flooring was made. Boards laid on edge and toe-nailed to the flooring made a baseboard to hold his household belongings. He had made his camp on the order of a squatter, with oilcloth for shelter from the rain. His fire was burning brightly in the stove. Since he was about ready to have supper, he offered to serve his newly arrived guests. They declined, but told him they had come to take him to a safe place.

Then it was, that they had discovered they had found a different kind of individual. He did not want to be taken anywhere. He insisted upon their coming on his raft and letting him show them how safe he was. He had made one for his chickens and had penned them on it. Another raft

(*Concluded on page* 54)

Corrosion of Metals
by LYNN THOMAS

CORROSION is deemed one of the major problems of the airplane structure. Only through periodic inspection may harmful signs of this failure be determined.

Corrosion may be defined as the intercrystalline action that transpires when a metal is exposed to varying atmospheric conditions. This results in a loss of metal which is worn away by the different atmospheric conditions.

As iron is the principal element used in the various steels employed in aircraft construction, it is one of the elements that presents the most difficulty and this metal is also formed so that it is very susceptible to corrosional impulses.

Usually a thin coat of hydrogen is occluded from the metal when metal is present in water. This forms a hydrogen film which tends to collect on the metal and obstruct the progress of the reactions by insulating the metal from the solution. The gas aids in the fight against corrosion.

In the course of time a coating of rust forms on the metal and for a time it acts as a preventive until more hydrogen is removed from the iron. The same reactions also take place on acid solutions but at accelerated rates. As the hydrogen gathers it is forced off in the form of gas bubbles.

In irons and steels that are badly segregated, corrosion will take place much quicker than it will in irons and steels that have a cleaner segregation. This is also noticed in metals that are electropositive or electronegative and where these characteristics are in contact.

It is found that alloys of unprotected aluminum have a rapid reaction in salt air as a mild acid is formed as a covering.

Stainless steels, alloys of nickel, silicon, chromium, and aluminum are found to be resistant to these conditions if properly alloyed, although in a course of time corrosion does occur.

There are many ways to prevent the corrosion of these metals, some of which are by use of paints, metallic films, and greases. Of the different types of paints in use they all perform in a different manner, although accomplishing the same result.

As you know, the primary purpose of applying protective coatings to stop corrosion is the fact that these coatings will prevent this action in the first stage if they are applied within a reasonable length of time. All dissimilar metals, such as magnesium alloys and duralumin should be kept from coming in contact with each other as that tends to cause the metals to corrode.

One of the paints used in the prevention of corrosion are: graphite, linseed oil paints mixed with a pigment of red lead, oxides of iron, and aluminum oxide. The paints must be of an inactive type with the adjacent metals. Pigments are usually used to serve this purpose. Linseed oil in paints absorbs oxygen from the atmos-

(*Concluded on page* 54)

U. S. Coast Guard Aids Sponge Fleet

A U. S. Coast Guard plane drops warning.

THE sponge fishing fleet off the coast of Florida is out of touch with land for as long as three weeks at a time and only about seven of the more than one hundred vessels in the fleet are equipped with any kind of radio.

A hurricane is a real danger to the several hundred men making up the crews of these vessels. At Tampa, Florida, the weather observers of the government notify the Coast Guard Air Station at St. Petersburg of every tropical disturbance which may threaten trouble for the northeastern waters of the Gulf of Mexico. Seaplanes are sent out to cover a wide area over the Gulf at once and each one carries a supply of small wooden blocks to which are attached a three foot yellow streamer bearing the words "Hurricane Warning" in black letters.

When the plane sights a boat the pilot flies low and one of the signals is dropped. The buoyant wood blocks bob along on the water and are recovered by the crews of the sponge fleet for return to the air base.

One of the Coast Guard signal blocks with a "hurricane" streamer.

The New Breguet Helicopter

by ERNEST NAGY, Jr.
European correspondent for
POPULAR AVIATION

AT LAST, the ambitions of Louis Breguet seem to be on the eve of fulfillment, for after many years of research, he has produced a helicopter that actually flies.

Get the earliest book on aviation that you can find in the library and you will, nine cases out of ten, find reference to M. Louis Breguet and his pet helicopter hobby. We shall await with interest, the outcome of these tests and the improvements that follow them.

THE French Bréguet Company, one of the leading aircraft manufacturers in France, has recently developed a new type of helicopter or, as they call it, a Gyroplane.

The basic idea is not a quite new one. M. Louis Bréguet, president of the company, made in the early years of aviation (1908), some trials with the ancestors of this gyroplane. These machines had biplane rotor blades or hélices.

As you probably know, the helicopter has no wings nor a tractor or pusher propeller. It flies and is supported by its engine-driven rotors with vertical axes and all movements of the machine are controlled merely by tilting the axis of the rotors.

The principal difference between a helicopter and an autogiro is that the helicopter has only one or two rotors and these are engine driven, while the autogiro has one rotor and a tractor propeller, the latter being actuated by the engine while the rotor is driven by the slipstream.

The new Bréguet gyroplane is the joint development of M. Bréguet and M. Dorand. It was intended to build a "flying laboratory" for scientific and practical researches, so attention was paid only to the rotor and rotor-head mechanism while the other parts are nearly all provisional. The whole machine consists of a fuselage on which is mounted an undercarriage of unusually wide track.

A tail and nose wheel are fitted while the fixed vertical and horizontal fins are only for assuring the stability.

In the forward part of the fuselage is the 350 h.p. Hispano-Suiza radial aircooled engine. The engine is mounted with horizontal axis and drives the rotor through a conical gear. The rotor consists of four blades mounted in pairs, each pair of blades forming a giant propeller of 53 feet in diameter.

Two pairs of cantilever blades, which are metal covered structures, rotate in an opposite sense, thus eliminating torque. The mounting of the rotors makes possible the tilting rotor axis which controls the lateral movements of the machine.

Vertical movements are controlled by changing the angle of incidence of the rotor blades, so that the machine can fly either vertically or horizontally. This enables it to fly vertically off the ground and after a substantial gain of height, continues the flight horizontally and lands on one spot without rolling, thus making flying fields unnecessary. The safety factor of the blades is 15. The normal rotational speed of the blades is between 2.2 and 2.5 revolutions per second.

Here we have the latest Breguet helicopter or "Gyroplane" as its inventor now chooses to call it. This picture was taken while the machine was in full flight and this shows one of the highest, if not the highest, helicopter flight in history.

The empty weight is 3160 pounds with an all-up weight of 4500 pounds. The total lifting power of the rotor is 7100 pounds so that there remains a useful lifting power of 3900 pounds.

The French Air Ministry's requirements for helicopters are as follows: (A) a flight of 500 metres in closed circuit in an altitude of at least 10 metres. (B) Altitude flying to 50 metres. (C) Flight of at least one hour duration. (D) A ten minute flight, at least 10 metres altitude within a rectangular prism on a square base of 50 metres side length. (E) A left and a right turn of a maximum of 50 metres radius in an altitude of at least 10 metres. (F) Flight with at least 100 km/h horizontal speed.

The machine has recently established a new helicopter world height record of 158 metres. The previous record was 18 metres and it has also accomplished all the other requirements. M. Bréguet plans to develop the gyroplane further and his plans also include commercial gyroplanes and hydrogyroplanes with 18-20 passenger capacity.

END

Development of Aircraft Ordnance

by
ROBERT C. HARE

A typical German observer's equipment in 1918. The gun is a Parabellum reel-belt type. It is shown mounted on a Halberstadt CL.II.

FRENCH air maneuvers in 1910 brought the first recorded attempt to stalk one airplane from another.

Of course, it was all in fun, but an enterprising young Colonel ordered an old Farman to intercept an "enemy" machine which he learned was due to pass over his area in a few minutes. To make the experiment more realistic the observer assigned was told to take with him a Lebel rifle, but was warned to see that it was not loaded.

The "enemy" was approached, and in the running fight that ensued several "shots" were fired at close range. Confident that his marksmanship would have downed the unsuspecting machine, the observer made special note in his report that he had utilized the target plane's blind spot to advantage.

This French officer was not the first to realize the value of a flying soldier, however. As early as 1751, R. O. Cambridge's "Scribleriad" was illustrated with an engraving showing a defeated British airman desperately clutching the legs of his German victor at an altitude of about 12 feet.

Peter, first gunner in Robert Patlock's "Les Hommes voland ou les adventures de Pierre Wilkins" published 12 years later, was the 16th century ace of aces. He was credited in this fantasy with having shot 300 of the enemy from the clouds.

Evidently these old timers were extreme militarists for 160 odd years passed before modern scientists gave serious thought to the practical application of arms to aircraft. British army maneuvers in 1912 were scouted by a none too reliable Bristol pusher while the Balkan and Tripolitan campaigns of about the same period taught progressives many valuable lessons in the use of aircraft in war.

At this early date guns were seldom if ever carried, and the lack of opposition offered no opportunities to develop the military value of aircraft except to prove that one airplane could scout more territory more thoroughly in one hour than a cavalry troop could cover in a whole day. The military airplane was still in its cradle. The fighting plane was stymied until suitable armament could be provided. There was no need to produce great quantities of super aircraft.

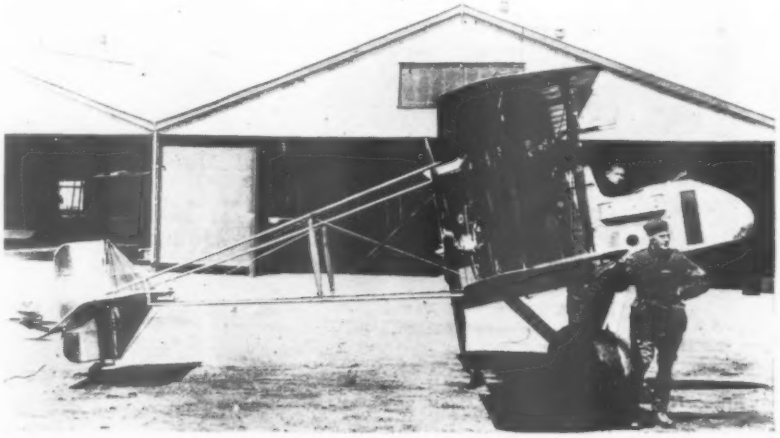
But, in 1913 aircraft design received an impetus when England adopted the Lewis gun as standard for R.F.C. machines. Oddly enough, the Lewis gun was not fitted to any extent until late in 1914 because it had not yet been provided with a suitable mounting.

At this time, the efficiency of the machines then in use was hoped to be increased by fitting a second Lewis gun in such a way that its fire cleared the airscrew arc, but air resistance from the clumsy mounting slowed down the planes 5 to 10 per cent and reduced precious ceiling correspondingly. Thus early observers were forced to scout enemy armies without arms aboard.

Small arms and rifles can be given the real credit for starting war in the air. In April, 1915, an observer in No. 4 squadron, R.F.C., actually downed an Aviatik at 80 yards using a service rifle. About the same time Captain Mapplebeck was wounded in the neck by a German rifle slug.

A demand for more efficient rifles brought the Martini-Henry, a .45 calibre piece which fired a primitive incendiary bullet. Over in France the Hotchkiss rapid-fire rifle made its debut. Everything conceivably horrible was used, including steel cables, skyrockets, steel hooks and grapnells, even steel darts, and refuse.

Germany led the parade by building an efficient ring mount for her two-seaters which made it possible for observers to make good use of the Parabellum machine-gun attached thereon. It was from behind this type of gun, in a two-seater, that many



Before the days of synchronized guns, the pusher type plane was used. This an F.E.8, a British pursuit plane of 1915-1916.

XUM

During the World War Period

later famous German aces received their baptismal fire.

By July, 1915, the British had devised a makeshift mount for the Lewis gun, not a movable ring, but a rail on either side of the front cockpit. The idea was to clip the gun on one side or the other as needed and to slide it back and forth on its track to aim.

Some B. E. pilots of the period went so far as to mount a second Lewis gun behind them, and turn around in their seats to fire backward.

So much for early two-seater development. By the end of 1914 it had been discovered that the fast single-seater had certain advantages over the slow gun-carrying machine. The first few weeks of 1915 found Allied ordinance departments frantically fitting machine guns and automatic rifles to their scouts in an attempt to produce an Aviatik antidote.

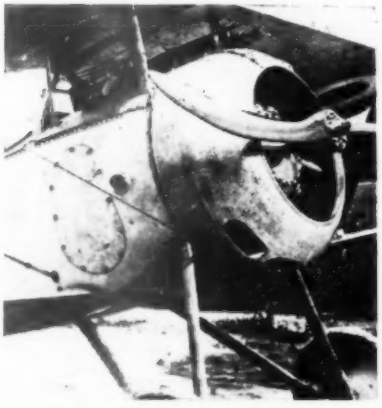
France adopted the Hotchkiss mounted to fire over the propeller disc. British scouts came out with a similar device for the Lewis gun which had been abandoned the year before.

The greatest basic idea of the time, however, was applied to a Morane "Bullet" monoplane, an advanced type which had been held up waiting for guns. Roland Garros has been credited with the idea of fitting steel wedges to the propeller in line with the bullets.

These steel wedges were attached with their points facing the gun muzzle and deflected slugs right or left that would otherwise puncture the blades. Constant banging, thus received by the propeller, soon split and shattered it.

This or motor trouble from the same source forced Garros down behind the German lines. The capture of his machine is probably the most significant misfortune in the development of the modern airplane.

In Germany, Anthony Fokker had produced some very efficient little single-seaters based on his 1913 looping monoplane,



A 1917 Nieuport with a typical single-gun mount. This is a Vickers gun with a disintegrating belt.

A French Voisin IX bomber mounting a 1½ pound cannon with telescopic sights. Note, also, the early insignia.

but the problem of arming them effectively limited their capacity to scouting. It remained for Fokker, after investigating the Garros deflectors, to germinate the idea of synchronization. Fokker's trials in this vein are too well known to re-tell here. Results of his fast monoplanes during 1915 have become legend.

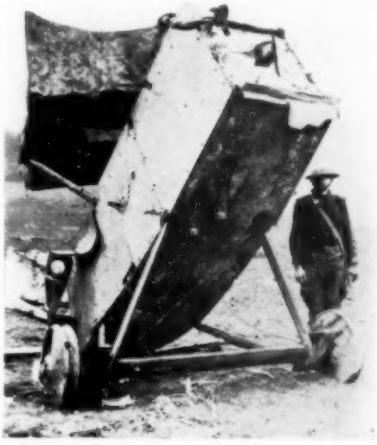
His first experiments were carried out with a Parabellum gun, but the belt reel offered too much trouble to be practical.

The Spandau proved to be Germany's best bet in this line, and the Allies' undoing. A Spandau was nothing more than a lightened Maxim infantry gun, water-jacket perforated to permit cooling by air. This weapon weighed 27½ pounds and fired 450 rounds per minute. It was fitted to the early Fokker, Pfalz, Halberstadt and Albatross machines in units of one to three, two guns eventually becoming standard.

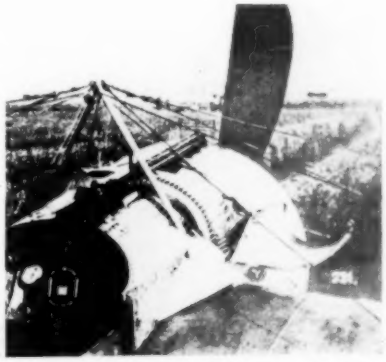
Compelled by necessity to get after these machines, the British evolved single-seater pushers D.H.2 and F.E.8 in preference to the Lewis wing mount. All had a remarkably good field of fire in spite of their appearance and were mighty good machines. In the pushers, a machine gun was mounted in the nose of the nacelle in front of the pilot. This was the British answer to the synchronized gun.

The French stuck to the wing mounted pieces, and appeared to wait for someone to develop a good gun for them.

As the days of 1915 came to a close, British pushers were coming out in large numbers to stem the Fokker tide. For use on Allied two-seaters, the famous Scarff mount was developed, but observers were objecting to the short life of a Lewis ammo drum. The old 47 round drum expired after 5 seconds of continuous fire. In July, 1916, the old drum was replaced by a double



A ruined German A.E.G., Type J.I. armored biplane. Two guns are shown through the floor.



The first synchronized machine-gun, mounted on a Fokker E.I. in 1915.

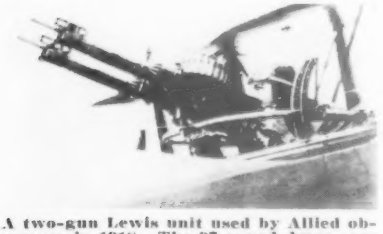
container which held 97 rounds of potential death.

The next improvement was in the form of a practical tracer bullet perfected for the sole purpose of aiding the gunner in aiming at his target. Until August, 1916, tracer had been used sparingly and experimentally. Lead slugs were the standard shot. Vickers hit on the right construction however, and by October, 1916, tracer was alternated in every drum.

Improved German types soon out-dated the Allied pushers and make-shift pursuit types which performed their duties quite well, but it remained for the Vickers people to invent a set of synchronizing gears in order to market their highly approved gun for Allied aircraft.

Thus, on March 25, 1916, a Bristol type "D" scout so fitted arrived at St. Omer aerodrome, passed its tests successfully, and proved a potential threat to the Germans. This Vickers gear actually fired the

Early Nieuport with a 47 round Lewis gun. Compare with deep 97 round drums below.



A two-gun Lewis unit used by Allied observers in 1918. The 97 round drums are used.

machine gun rather than interrupt its fire as did the Fokker gear.

Other gears which appeared at the same time were the Scarf-Dobovsky, ARSIAD, Ross and the Sopwith-Kauper. Each had its "bugs" and none was used to any extent.

In the summer of 1916, a Roumanian inventor, George Constantinesco, working on a new principle, fitted his oil impulse gear to a B.E.2C and demonstrated it before the Military Aeronautics Directorate. Because of its simplicity it could be universally fitted to any type of motor, whereas the aforementioned gears were built integrally with the motor and required different arrangements for each power plant.

The Constantinesco gear consisted of several feet of copper tubing filled with a fine column of oil under pressure. A small pump fitted to the motor sent an energy impulse through this oil line to the gun trigger which was engaged for firing at the

(*Continued on page 64*)

Lightplane Building in the Netherlands
by N. V. KONINKLIJKE MAATSCHAPPIJ

The Schelde "Musch," a lightplane built in the Netherlands that much resembles a well known American pusher type.

IN the Netherlands we find a firm manufacturing lightplanes seldom mentioned in the United States. This group has felt the need of a small lightplane with a low powered motor that will answer the plea of many sailplane enthusiasts, for it will enable these individuals to obtain experience in power planes with very little additional instruction.

To meet this demand, the organization of "Schelde" has designed and constructed two light planes, the "Schelde-Meeuw," a light flying boat and the "Schelde-Musch," a lightplane for sports use. In addition to these planes Schelde has developed a sportplane designated as the Schelde S-12 which is built for economical and comfortable transport of three persons.

The Schelde-Meeuw is a one-seat flying boat bi-plane, that is easily started on rivers and lakes, meeting the demand of those who wish to combine aquatic sports with flying. The wings consist of two spruce spars, spruce truss ribs, partly covered with bakelite plywood; the ailerons are mounted on the top wing, and the main surface of the wings is covered with fabric. There are floats of fabric covered balsa wood at the wing tips, thus affording stability in the water. The fuselage consists of transverse frames of spruce and plywood, longitudinal spars of spruce and plywood covering; the bottom of the hull is reinforced with crossing plywood strips and has one step. A large and comfortable seat with "scellon" covering is in the front of the boat, with a simple dashboard and easily read instruments. The power plant is mounted in the trailing edge of the upper wing, and drives a pusher propeller.

The motor is a Praga "B" developing a maximum of 40 horsepower at 2400 revolutions per minute, and a cruising power of twenty-seven horsepower at 2100 revolutions per minute. The ship uses approximately two gallons of fuel per hour at cruising speed, and has a top speed of seventy-eight miles per hour, cruising at sixty-five miles per hour. The ship will land at thirty-seven miles per hour, due to the great area of the bi-plane surfaces. The Schelde-Meeuw will climb five hundred feet per minute; has a service ceiling of eleven thousand five hundred feet and will take off in five hundred and ninety feet. The range of this light flying boat is two hundred and twenty miles.

SPECIFICATIONS

Span	22 ft.
Overall length	17 ft. 4 in.
Overall height	8 ft. 2 in.
Wing area	142 sq.ft.
Wing loading	4.7 lbs. per sq. ft.
Tare weight	440 lbs.
Useful load	220 lbs.
Power loading	16.5 lbs. per h.p.

Due to the growing demand for a light

(*Concluded on page 73*)

The Schelde S-12 a cabin job built in the Netherlands that seats three persons and is intended for light commercial work or as a sportplane.

"Overweather"—the Future Roadway

by S. R. WINTERS

A review of the experiments, past and present, in ultra high altitude or sub-stratospheric flying. Will we fly in the sub-stratosphere and if so, what can we hope to gain?

"OVERWEATHER" is a word recently copyrighted by Transcontinental and Western Air officials to describe the zone wherein future commercial flying will undoubtedly take place. This overweather altitude betters 20,000 feet and is, therefore, theoretically free from disturbances caused by storms and winds.

With the perfecting of planes and equipment necessary for such high flying, the pilots of tomorrow may strike and maintain a rate of speed hitherto considered impossible. To lift the transport plane of the future (which, it has been roughly estimated, will develop a wing-spread of fifty feet and carry half a hundred passengers) up to the sub-stratosphere and maintain it there at exceptional speeds, the new General Electric Company turbo-supercharger is being developed at the Thompson Laboratories in Lynn, Massachusetts.

Unofficial prophecies declare that within two to seven years, flying at a seven-mile altitude in overweather planes will be the taken-for-granted mode of travel, especially for non-stop, eight-hour flights between coast and coast. Trans-oceanic flights will probably occupy eighteen hours.

As we all know, the atmosphere at great altitudes is exceedingly thin. Therefore, for successful navigation therein, the airplane-motor must be equipped with a supercharger which, like a fan blower, maintains sufficient air pressure to allow the gasoline-motor to perform at super-normal speeds.

When we look back even seven years to the time when the 575-horsepower engine with 120-mile-per-hour speed was "tops" in American power units and find today that 1,220-horsepower engines zip along at nearly 200 miles per hour, almost anything by way of speed seems attainable in years to come.

Out in Dayton, Ohio, experimental tests with the new General Electric turbo-supercharger are being made by T. W. (Tommy) Tomlinson, crack pilot of TWA, who broke all transcontinental records for transport planes by flying coast to coast in eleven hours and five minutes. Cooperating with Tomlinson are James Heistand, development engineer of the same company, and W. H. Reeves, supercharger expert of General Electric. These three men recently hopped from Kansas City to Dayton, Ohio, at a 250-mile-per-hour speed, flying at 30,000 feet in a fifty-below zero temperature. A 374-mile-per-hour rate was acquired on another trip.

From a Kansas-City-to-New-York hop performed by Tomlinson, proof was considered as definitely established that transports attaining such heights, beside being capable of an extremely rapid acquisition of speed, are able to maintain it with a minimum of motor-power.

Perhaps of equal significance was his dis-

Wiley Post's "Winnie Mae," one of the first planes to make serious attempts upon the sub-stratosphere. Now in the National Museum.

U. S. A. Air Corps Photo

A Boeing P-12E, of the U. S. Army Air Corps, equipped with supercharger for high altitude work.

The T.W.A. Overweather experimental plane used for high altitude research.

covery that surface radio aids function adequately in the sub-stratosphere. The return hop from New York to Kansas City, made two days later, was improved by a blind flying experiment. The cockpit was covered by a hood and a homing compass employed. From Newark to Pittsburgh a radio beam was accurately followed; at Pittsburgh a broadcast from Columbus, Ohio, guided the pilot to Kansas City where the cockpit was uncovered and an ordinary landing made.

The all-metal plane used by Tomlinson and Heistand is a Northrop Gamma, fitted out as a laboratory for aeronautical engineering experiments. The recordings of the instrument board, holding thirty-six delicate instruments, were not merely jotted down in figures but a more exact method was employed. Photographs of these instruments were taken every thousand feet by a camera suspended on a fixed mounting at the rear of the pilot's compartment.

To conquer the dangers attendant upon sub-stratosphere flying, various complicated problems must be worked out. For one thing, a special sort of air-conditioning must be perfected to combat the rarefied atmosphere and the sub-zero temperature. The cabin of the plane, sealed against leakage, must contain adequate internal pressure to prevent the plane from exploding.

Naturally, there is a tremendous variance in the pressure registered at sea level and at sub-stratosphere altitudes. Equalization of the stresses and strains within the plane caused by rapid shifting of pressure, bids fair to compel an enormous amount of experimental research. A pressure of 3.46 points per square inch at a 36,000-foot altitude increases to 14.7 pounds per square inch at sea level.

The normally aspirated engine loses power so rapidly with altitude that scarcely more than twenty per cent of the power manifested at sea level is attained at 35,000 feet. The properly developed supercharger is calculated to take care of keeping the power constant as well as to build up the internal pressure.

In overweather flying the internal pressure of the plane will probably be kept close to 1,250 pounds to the square foot to correspond with the equivalent of normal air at an approximately 5,500-foot altitude. This pressure will necessitate the use of window glass from five-eighths to three-fourths inch in thickness. Comfort for the passengers will be the watchword in these new planes and air conditioning of the cabin will, in a large measure, insure this. Ear pressure will not be changed during flight regardless of the altitude or rate of climb.

Of course, the General Electric turbo-supercharger is but an innovation of the original invention designed to furnish pressure-rise by reason of rotative speed and construction detail; to prevent a drop in power above moderate altitudes, or more specifically, to present to the engine cylinders (by compression of the atmosphere) an equal weight of charge such as would naturally be accepted at sea level.

Provision for increased power in emergencies at sea level will be supplemented by the vaporization and distribution of the engine-charge, with carbureter and inlet-pipe simplification at all times. The airplane engine, as a rule, is ordinarily operated

U. S. A. Air Corps Photo

Le Pere supercharged plane of 1923, used by Lieut. J. A. McReady, in breaking the altitude record.

through a limited range of speeds, but on occasion a demand for speed considerably above the normal is imposed on it. The supercharged plane engine is likely to deliver at a given rate of speed, its maximum power, with marked decrease previous to and following this acceleration.

An interesting testimony denoting the comparative swiftness of aeronautical developments within a few year's duration is furnished by reference to a book on power plants published a mere decade ago. This treatise included mention of the use at that time of superchargers in connection with certain military craft and followed this with conservative prophecies that such devices in connection with airships and commercial aircraft in general might be a future possibility.

To counter-balance this, a current paper prepared for the forthcoming meeting of the Society of Automotive Engineers declares: "No doubt a number of satisfactory airplane engines without superchargers are existant, but the number of engines using superchargers and the rate at which this number is increasing constitute proof that superchargers give an important advantage . . . Any good engine not equipped with a supercharger will be a better engine if a supercharger is installed."

The 1926 write-up referred to, mentioned General Electric's part in developing this device to a satisfactory degree. The Army was already employing several of them. The French had developed one of the exhaust gas turbine types for use with their own military service.

Even as long ago as the world war period many proposals were considered for the supercharging of aircraft engines, and one of the first examples was produced for the Curtiss Company in 1917. The primary development work was given over to the General Electric Company and to the British Thompson-Houston Company, with engineers of the Navy Bureau of Aeronautics, the Army Air Corps and the National Advisory Committee for Aeronautics assisting.

Engineers of the Pratt and Whitney and Curtiss Wright Companies also cooperated and the combined efforts of these participants speeded up the development at a rapid rate. The primitive form of the geared supercharger necessitated the use of a separate gear-train and external gear casing, a set of supercharging casting and air conduits.

It was then a separate unit attached to the engine (which was of the water-cooled in-line type) by bolts. Nowadays the engine is expressly designed for the attachment of the centrifugal supercharger which is built directly into it without external casings. In other words, the supercharger is no longer an external adjunct to the airplane engine, but an incorporation of it.

One significant feature of the supercharger is that it furnishes automatic pressure at the carbureter intake and likewise has a corresponding effect on manifold pressure, almost wholly eliminating the need for manual-throttle control, thereby lopping off one of the tasks ordinarily required of the pilot when aloft. The supercharger operates by oil pressure, which is regulated from the waste trap and actuates the check valve.

Medical tests have been under way for some time in order to study the effects of oxygen starvation in passenger and pilot. Dr. E. H. Padden, flight surgeon of United Airlines, made several such tests in a flying laboratory. It was found that altitude between 16,000 and 22,000 feet above sea level affected the persons in question both by slowing down their reactions and causing lapses of memory. This effect was promptly remedied by the administering of oxygen. Since the moisture content of ordinary oxygen causes the freezing of lines in such a frigid temperature as that endured in overweather flying, a specially dehydrated type of oxygen is necessary.

Interesting experiments conducted by Dr. Padden included the examining of his passengers in mathematical problems and grammar without the introduction of oxygen. Under these circumstances and at a 17,000-foot altitude, mental reaction was torpid and the answers to problems invariably incorrect. A thousand feet higher, with the use of oxygen, the correct solutions were given to all questions and reactionary speed equaled that under normal conditions at a 10,000-foot altitude.

Tests presented at 22,000 feet with the use of oxygen likewise secured correct answers while tests at 20,000 feet, with no oxygen employed, brought no correct answers. Physical motion tests at 19,000 feet showed inaccuracy of movement as well as lack of concentration. These tests were carried on with a newly invented valve equipment that allowed the occupants of the plane to undergo experiments while the surgeon and the pilots remained unaffected.

To the layman, unversed in even elementary meteorology, it may not be amiss to explain something of the weather difficulties met with by pilots, particularly over bad terrain and its consequent atmospheric conditions. Remembering the dangerous air-lanes over the Allegheny Mountains where the cold and hot fronts of air meet with resultant storms of great violence, one can not but entertain optimistic speculation on safe and sane travel in that locality when overweather flying is perfected.

In this section, the hot weather moving

(*Continued on page* 58)

The NATIONAL AIR BOARD *Says*— *Unbiased Opinion to Further National Aeronautics*

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ALEXANDER KLEMIN, CHAIRMAN

THE TENTH MEETING of the Air Board was held on March 3rd and it appeared that two or three members were in Florida. The Board was delighted to learn that it had members who could go to Florida!

SUGGESTIONS FOR AIR BOARD TROPHY INVITED

The exact character of the proposed Air Board Trophy again came under discussion. The general opinion was that readers' ideas should be awaited. So once more an appeal is made to readers to write in *immediately* to give their views on this important topic. Address: National Air Board, % Popular Aviation, 608 South Dearborn St., Chicago.

ALL FRENCH FIRST CLASS MAIL CARRIED BY AIR

It will be recalled that a recent vote of the Board recommended that all first class mail in the United States should be carried by air *without* extra charge. The French Government has now adopted precisely this plan—which is an added argument in favor of such a policy.

A BILL TO SECURE GREATER INDEPENDENCE FOR THE AIR CORPS

Full discussion was given to an important bill introduced by Representative Wilcox of Florida.

"More planes, more bases and an organization freed from the dictation of ground generals are essential if we are to have a real air force capable of actually defending us in an emergency," Mr. Wilcox said. "Under the proposed plan, the Air Corps would function within the War Department in much the same way as the Marine Corps which now operates within the Navy Department," he said.

U.S.A. Air Corps Photo

A lineup at Selfridge Field during the winter maneuvers, held recently, gives an idea of the modernization of our aerial arm.

"The rank of air marshal would compare with general in the army and admiral in the navy. The present Air Corps would be transferred to the proposed new force immediately upon passage of the bill but its ultimate strength would not be attained until five years after passage of the act. The air marshal would have two vice marshals, one of whom would be in control of all flying, the other charged with procurement. There would also be twenty-five air commodores, which would be comparable to the rank of brigadier general; 4,500 flight officers, 100 warrant officers and 45,000 enlisted men. The commissioned officers would be in the grades of lieutenant to colonel, but there would be only one grade of lieutenant instead of two as at present.

"The bill would also establish an air college to perform the same functions with respect to army aviation as the War and Navy Colleges and the training center at Randolph Field, Texas, would be changed to the 'United States Air Academy.'" Mr. Wilcox did not specify the number of planes to be procured during the five-year interval.

"Under existing law the President has authority to acquire a maximum of 2,320 military planes, but appropriations last year allowed for about 565. A similar number are proposed in the budget for the fiscal year beginning next July 1st. I have, therefore, introduced a bill providing for the establishment of the Air Corps as a branch of the War Department, but entirely free of the General Staff and reporting directly to the Secretary of War."

When national policies in regard to military and naval aviation are under discussion there emerge several different schools of thought:

1. All military and naval aviation placed in a separate Department, with a Secretary for Aviation at its head. The late General William Mitchell at once comes to mind as the most energetic and outspoken proponent of such a plan.

2. Placing Aviation, the Army and the Navy in one Department of National Defense.

3. Concentrating all defense aviation under the War Department.

4. Giving the Army Air Corps greater independence within the War Department.

Whether there should be a single Department of National Defense embracing Aviation, Army and Navy is not a question

U.S.A. Air Corps Photo

The same ships in formation flight shortly after the upper picture was taken, during the winter maneuvers.

XUM

for the Air Board to discuss, because of its rather specialized viewpoint.

A separate Department for Aviation is a fascinating idea, with avoidance of duplication, and more flying equipment for a given budget as likely results. But is it really possible to combine the functions of the Army Air Corps with those of Naval Aviation? Is not Naval Aviation a vital and integral part of the fleet and therefore rightly allotted to the Navy's direction?

If all defense aviation were turned over to the War Department, would not the Navy have a legitimate grievance, and be seriously hampered in its duties?

After serious and impartial debate the Air Board came to the conclusion that Representative Wilcox's Bill might be a workable and entirely commendable compromise. The Bureau of Aeronautics is within the Navy Department, but it has achieved a great measure of independence and functions with efficiency and without being hampered by "brass hats."

An Air Corps similarly free of control by the General Staff, with a chief reporting directly to the Secretary, would be equally desirable. We would have been standing for flight officers, no ground generals dictating aviation policies of which they know little, and in all probability far better and far more fighting aircraft. At the present time there is no doubt that we are lagging behind European countries in this respect.

D. OF C. EXPERIMENTS WITH CATAPULTS

Newspaper accounts make it quite clear that as a result of the airline accidents, the recent Safety Conference, and the appointment of a new director and assistant director in the Bureau of Air Commerce, this Bureau is likely to have far greater financial facilities at its disposal and to undertake much useful research in the field of aids to navigation. The newspaper announcement also states that the Department of Commerce will experiment with catapults for land planes.

Catapults for land planes are by no means a novelty. The Wright brothers used them in the earliest days since they had no landing gear. Captain Depew recalled that Bob Fowler some 27 years ago in Texas tied a Wright Biplane on a handcar and did some catapulting in a fine style. The German system of catapulting ships at the South Atlantic is too well known to need description. Catapulting is a well understood art which has already rendered the greatest service to aviation.

As Casey Jones put it, "We go to great trouble designing heavy and complicated retractable landing gears, draw them up into the wings in flight and only use them for a few minutes in the course of a full day's flying. Why not use catapults and perhaps dispense with the landing gear entirely, indirectly making for greater speed and greater payload?"

Mr. Jones' viewpoint was somewhat of a novel one to members of the Board; yet it is an entirely logical one. Catapults hitherto have been regarded merely as a means of getting seaplanes off the deck of a surface vessel or else as a means of over-

(*Concluded on page 60*)

Here Is a "Man-Power" Plane That Flies

This is the Bossi Man-Powered Airplane in flight.

FINALLY, we are able to show our readers a man-powered or muscle-powered plane that actually flies. It was designed by Enea Bossi, Philadelphia, Pa., and was flown by Major Vitorio Bonomi at Milan, Italy.

The ship is propelled by the pilot's feet, acting on pedals, and this system is said to be the first of its kind. It cost less than $500 to build and weighs only 200 pounds, empty. Bossi will enter this plane in the forthcoming contests to be held by the Italian Aero Club in Rome. These trials should prove highly educational.

The interior of the Bossi plane showing pedals.

Memories of the Zeppelin Raids Over London

by An Eye Witness

IT IS now eighteen years since the Armistice but to those who fought in the war or experienced any of the war at all, these intervening years might never have passed, as the memory of those four years will remain imprinted in their minds as long as they may live. We who waited in England day by day for the news which did not come until November 11, 1918, did not realize what war was—until we too experienced it in the form of air-raids and bombardments.

I was then at an age when whatever happened impressed me very much, and when I first heard a bomb fall just two miles from where I then lived it seemed to me like a rumble of thunder. The ground trembled and windows rattled with the vibration of the explosion.

We were allowed no lights, and we groped about blindly in the dark for our clothes, trembling with fear, because we did not know exactly what it was. All we thought was "the Germans are here!"

This happened night after night. We never knew when they were coming until we heard the bombs falling nor did we know when they had gone, only guessing by the rumble getting fainter and fainter and windows ceasing to rattle.

For about three years this went on, until our searchlights were improved upon and the guns made more powerful. Then came the night which partly compensated us for what we had suffered.

It was a pitch-dark winter's night and as usual not a sound was to be heard save motor-cycles (dispatch riders) going about

(*Concluded on page 66*)

Horses—Horses and Horses

by FLOYD LOGAN

In which the author, an old-time news-reel man, tells how the General arrived at his conviction that all news-reel camera men are liars.

AN orderly skidded to a stop and dismounted from his motor-bike. He flopped his goggles up on his sweating brow, coughed and said, "The General wants to see you." This was down on the Border at El Paso, Texas, in 1921.

Now, I had put in a lot of Army flying and I knew what he meant when he said, "The General wants to see *you!*" I wasn't in the service then but still I was flying around in Army ships, diving at the Rio Grande, International Bridge, taking pot shots at Juarez or drifting in over the Plaza Toros while a bull fight was in progress. All for a newsreel and the shots were merely film shots or "takes" for the International Newsreel, the firm I represented down there and not from the twin Lewis gun.

The Army had a couple of crates doing patrol duty at the time and the pilots, Major L. J. Hefferman and Lieutenant de Shield, were friends of mine. Both went far to satisfy the low-altitude whims of a cameraman and were not particular whether or not it was in United States or Mexico. More power to them—for that.

Brig. Gen. Robert L. Howze was the Commandant of the Eighth Corps Area there. He had had me up before him once before that day to satisfy his curiosity as to the question, "Why are all newsreel men liars?" They all were, in his estimation—but naturally I didn't agree with him on that.

You see—the General sort of had a newsreel complex. He liked to direct cameras and everything else. He was always cooking up something to take pictures of—whether or not his brainchildren had a news appeal, whether or not they coincided with the news editor's or even your own views.

Still, about every third subject the General promoted had certain news angles that would go over in the newsreel. Nor could he overlook the fact that the source of subjects was varied and, I might say gratis, out there at the Fort. So naturally we tried always to handle the General—or his ideas—in a diplomatic fashion, agreeing with him always, then using our own discretion.

He had asked me to shoot a lot of film on some trivial subject that was far from a newsreel topic and rather than argue the point I had said I would make it. Then, at the appointed time, when I failed to appear to cover the thing, the General was much annoyed and subsequently arrived at the alarming conclusion that all newsreel men were not what they were cracked up to be. And a fellow just can't fall out with a general like that you know. Not in this newsreel business.

Well, let's go see what the General wants this time. I hopped in the side-car and presently drew up in front of headquarters. That's right. Fort Bliss. Walking inside I got the nod from the Adjutant and promptly headed for the General's private office, wondering what he wanted to see me about. After knocking, I entered his sanctum.

There sat the General glowering at me. He certainly had command of a lot of expressions. In fact, I had been trying to make a newsreel actor out of him for many weeks. He spat at the spittoon, and missed.

"Well, Logan," said he, "I suppose you would like to redeem yourself in the good graces of the Fort and its personnel? Good standing with its officers and all that? Here's the way you can do so. Colonel

Brig. General R. L. Howze, who occupies a prominent position in this news-reel recital.

Langhorne is turning over his command of the Seventh Cavalry to Colonel Short, who recently returned from Coblenz.

"The entire Seventh will be out on review tomorrow afternoon, troop drill and that sort of thing. And the Seventh Cavalry was General Custer's outfit years ago, you know. There's something historical about that, Logan."

But I cut in, "Surely, I see, General, but troop drill and horse reviews are old stuff. Why, the crack army troop is right up there at Fort Meyer, Virginia, and our Washington man covers that on all special blow-outs. In order to make the reel, I would have to shoot something different, thrilling, something unusual and original, and if you will promise to work with me on this, I will gladly cover Colonel Short and the Seventh."

So he said that was agreeable and that he would do anything that I suggested.

Well, the General would not fly. He had never had both feet off the ground, and utterly refused all past requests that he partake in some aerial scene for me. Did his promise now mean that I could get him in the air with Colonel Short? If so, I could make a most interesting newsreel.

My original idea was to have Major Hefferman hop the General, followed by Colonel Short and Lieut. de Shield in the second ship. I phoned the General from El Paso to explain my idea, but he flatly refused to fly. Furthermore it seemed that the Colonel wanted to be at the head of the troop on horseback instead of looking them over from "upstairs."

So I had to do some more thinking and thinking in El Paso, Texas, in the month of July is rather a painful procedure. But I hit upon a plan and early the next morning we went into a huddle out there at the Fort.

The plan was simply this: The commanding officers would arrive at the flying field and there don flying garb. The pilots would have their motors warmed up and the General would climb in the cockpit of Hefferman's ship while Colonel Short would ride with Lieut. Shield.

Both ships would taxi off out of the scene. I'd cut the camera there and the distinguished officers would get out without flying. Then flash to the Seventh Cavalry lining up in formation, then a shot at the two ships in the air from the ground but minus the General and the Colonel, who got out of the ships after turning a few feet out of the scene without doing any flying. Their absence could not be picked up in the film at that great distance.

The ships in the meantime would return to the field and I would set up the camera in the front cockpit of the Major's ship. Then we would take off and climb to about three thousand feet, my camera lens looking directly through the whirling prop. We would wag our wings with the ailerons.

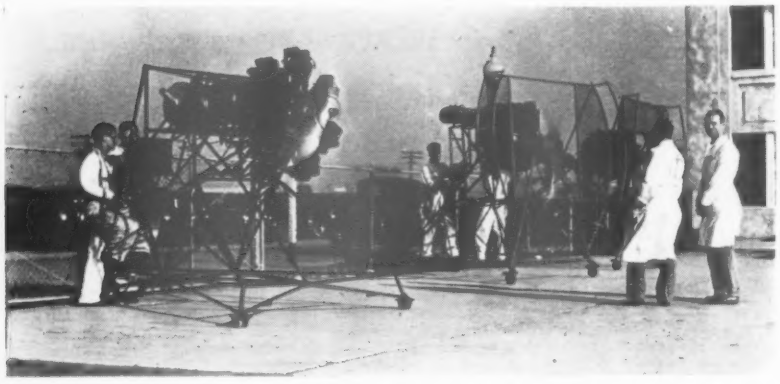
The entire Seventh Cavalry would then go into one high kaflooting-shootin', son of a gun of a charge, and we would zoom down in a steep power dive with our nose right on the charging cavalry. Meantime I'd be cranking out film as it all appeared between the prop blades.

That was something to write home about, gentlemen. That Seventh Cavalry looked the size of a dime at three thousand feet, growing bigger every instant as we dove, this wild careening cavalry, racing madly at us as we went over them ten feet above the horses' heads.

A four column cut appeared the following morning in the El Paso paper. The caption was, "They look 'em over from the clouds." It showed a picture of the Jenny with de Shield at the stick. Draped in the

(*Concluded on page 60*)

Problems in Engine Overhaul



Students are receiving instruction in the operation of engines on the test stands with the engines running.

by
HERBERT MARSH

Engine Instructor
Boeing School of Aeronautics

INCREASE in aerodynamic efficiency of the airplane, together with its established position in the field of transportation, has brought about an increase both in the demands on the power plant and the necessary knowledge and skill that should be exercised in the operation, overhaul and maintenance of power plants.

Every mechanic, skilled or amateur, is interested in the problem of overhauling aircraft engines. In this story I shall attempt to explain the methods in use at the Boeing School of Aeronautics, omitting, because of space limitations, many details of workshop practices and confining my remarks in general to principles, including certain detailed practices.

Safety in flying and the operating efficiency of airlines depend largely upon the reliability of the power plant. Skill in connection with power plant maintenance requires a thorough knowledge of the principles of operation of the plant together with a certain amount of workshop training.

The modern airplane engine, although possessing qualities and principles of operation of the ordinary mobile internal combustion engine, also possesses special accessories and is called upon to operate under entirely different conditions.

Mechanics who hope to be proficient in overhauling and maintaining aircraft power plants must understand the function of both the engine and its accessories. Pilots must also have a knowledge of the principles of operation of both the engine and its accessories, together with a certain amount of workshop training. As the utilization or consumption of fuels and lubricants will give different results under varying conditions, a study of the reactions of certain fuels should be included in both a pilot's and mechanic's training.

A powerplant is an installation of the necessary devices to make available a supply of mechanical energy, or generate or liberate such energy from the material, or substance in which it is stored. Gasoline is the most common source of supply for aircraft power plants. With a certain amount of reason we might then refer to the engine as the power plant, all other accessories being complementary thereto.

When dealing with a number of persons as is usual in school work, it is essential that each one is on about the same level with regard to his knowledge of the subject under review. It is mainly for this reason that a definite amount of lecture work is given previous to any shop work. The lectures should cover the primary principles of the power plant, and if any person in the group has had sufficient experience on the subject, the elementary lectures may be omitted.

Under this system we will have a group of students passed to the workshop and laboratories who are to a large extent what we might term as being on the same base, and may now be given assignments either individually or in groups.

During the period that shop work is being given it is advisable to run a lecture course concurrently, the nature of the lectures to be along the lines of explaining and demonstrating modern workshop practices together with a study of handling certain phases of the work being done in the shops. As an example let us take some of the shop assignments, the first to be "Ignition Timing."

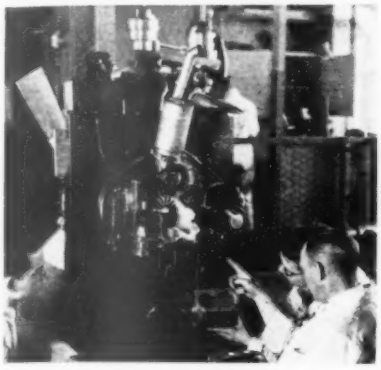
Previous to this assignment we have covered the principles of ignition in our lecture work and a study of ignition units has been completed in the laboratory. Workshop practice is therefore simplified and the possibilities of error greatly reduced. Shop assignments may now be broken down into a number of operations which we will review in the assignment "Ignition Timing," which usually follows valve timing.

We may review a valve timing project as follows, and by way of preface, let me say that radial motors should be checked on each cam lobe. Time the motor on any cam lobe and after timing turn the crankshaft in the direction of rotation through an angle of 720°. (2 Revs.) This will bring the next lobe into position and a check reading can be obtained. Repeat until each lobe has been checked.

Radial motors are sometimes timed with

A 1937 mechanic must know engines from stem to stern. Here a mechanic is servicing a United Air Lines Boeing 247D equipped with two 550 h.p. Wasp engines.

and How They Were Solved



The rear end of a cut-away Wasp engine is useful for primary instruction.

the push rods assembled on one cylinder only. When all push rods are applied a different timing usually exists, this according to the amount of cam ring bearing clearance. It is therefore suggested that all push rods be in position before timing a motor.

In somewhat greater detail, here are the steps for valve timing a line engine having a neutral timing; meaning no valve cap or end:

Adjust all tappets to the proper clearance. Find T.D.C. Place No. 1 piston in neutral position as per manufacturers' specification; i.e., in position for inlet open and exhaust closed as the example calls for neutral timing.

Place camshaft in neutral position for cylinder No. 1; i.e., inlet tappet will just be touching and exhaust tappet will also be touching, or rocker arms will be touching the valves. Tie in the camshaft and crankshaft as arranged by the constructional features of the engine.

Check inlet open and exhaust closed for No. 1 cylinder. Advance crankshaft one revolution; this will bring the rear cylinder in position for valve action, and a check timing can now be made on this cylinder.

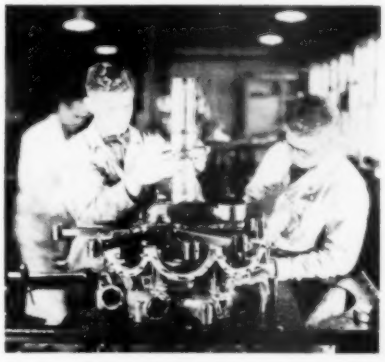
If any difference occurs between the timing of No. 1 cylinder and the rear cylinder the difference, or error, should now be adjusted so that only one-half of the error exists. Provision for this adjustment is usually incorporated in the engine design and is usually in the nature of serrated or spline shafts.

When engines are specified as having a "hot" and "cold" tappet clearance, or a "running" and "timing" clearance, adjustment of tappets will be according to the "hot" or timing clearance. After completing the last adjustment in the above paragraph, the tappets should be re-set to the "cold" or running clearance. This should be performed accurately with suitable gauges and then results should be checked.

Having completed valve timing, the Top Dead Center and pointer should be in the correct position. The operation of ignition timing then follows:

Operation 1. Place Number 1 cylinder in position for firing.

Operation 2. Set ignition (magnetos) for distribution to Number 1 cylinder.

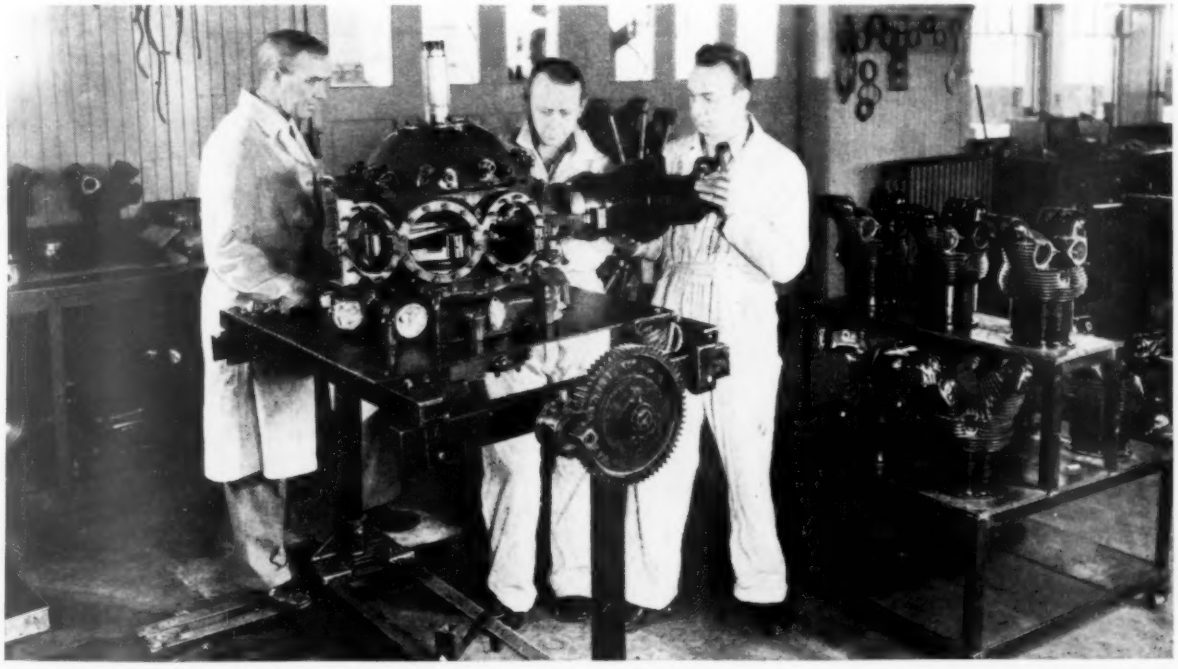


Student mechanics are shown assembling a Hornet engine.

Operation 3. By the fine adjustment that is incorporated in the ignition drive unit, set ignition so that breaker points are just opening. This action may be determined either by cigarette paper between breaker points or 6 volts electric lights. Time required approximately 15 minutes.

It must be understood that the reason for reducing any particular assignment or piece of work to a definite number of operations is not only to save time, but to a large extent reduce the possibility of making an error.

It is customary to describe ignition as taking place a certain number of degrees before Top Dead Center, but as there are two Top Dead Centers in the cycle of



The author (at left) supervises the work of a student in properly assembling a Wasp engine after overhauling in the Boeing shops.

operations of a four-stroke cycle engine, and as these two Top Dead Centers are 360 degrees apart in the cycle, it is evident that an error of 360 degrees may be made in ignition timing.

But as the principles of engine operation have been studied and as Operation 1 distinctly calls for Number 1 cylinder to be placed in position for firing, which means the specified number of degrees before Top Dead Center on the compression stroke, no error can exist if the operation is as called for. All operations should be predetermined and then carried out as per instructions.

We can then say that the handling of engine overhauls can be completed in detailed operations and that the operation can be classified as major, each major then being further broken down or subdivided. This method should apply to a well organized shop where sufficient volume is being handled to enable operations to be done either by one man or by one section.

For an example, let us take a standard Pratt & Whitney radial engine and trace the complete overhaul of same, assuming the engine is removed from the airplane and has entered the engine shop on an engine stand. The first major operation may be termed the "tear down" and the process reduced to the following minor operations:

Operation 1—Remove all accessories such as carbureter, generater, magnetos, etc. These components, if sufficient are coming through the shop, may now be sent to a special section where the overhaul of each accessory becomes a major operation.

Operation 2—Remove all cylinder assemblies. These as stated in Operation 1, may go to special section.

(Note: When removing cylinders the one carrying the master rod should be the last to be removed. Operations are reversed during assembly).

Operation 3—Remove nose section (assembly).

Operation 4—Remove front half of crankcase.

Operation 5—Remove crankshaft assembly. (This assembly may go to special section).

Operation 6—Remove rear half of crankcase.

(*Concluded on page 52*)

On this special test stand recently rebuilt, overhauled or brand-new airplane engines are given an exhaustive test.

HOW'S THIS FOR A HAMBURGER STAND?

Slightly delapidated in its upper stories because of the visit of a Florida wind storm, this veteran old naval seaplane serves as a sandwich-stand attraction today.

THIS model F5L ex-navy seaplane, perched on top of a wayside sandwich stand, is a unique advertising medium for Mr. A. W. Griswold, ex-pilot and owner of the Mystery Ship Sandwich Stand, located 4 miles south of Bradenton, Florida. It was purchased for $165.00 from the Navy and had previously been in service for two years with the Atlantic Coast Airways, flying between New York and Atlantic City in 1927-28. It was brought to Florida to open an air line between St. Petersburg, Florida, and Havana, Cuba, which failed to materialize.

This ship was then hoisted on the top of this sandwich stand with the aid of house jacks and guy wires, where it remained in perfect shape until it met with a tropical storm in 1935, which ripped all the fabric from the wings and made it unserviceable for further flying.

It was powered by two Packard Liberty motors and has a wing spread of 110 ft. and a 60 ft. fuselage.

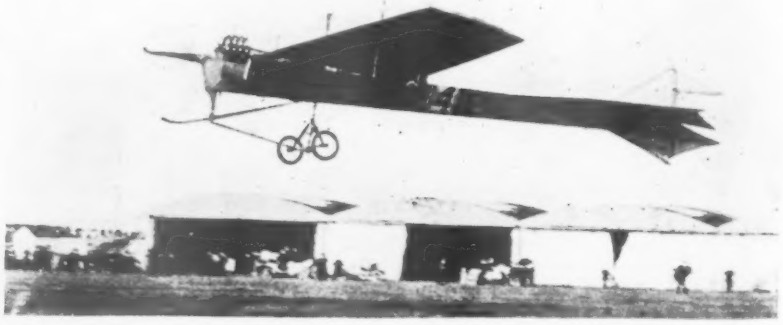
HUBERT LATHAM'S ANTOINETTE MONOPLANE

FROM 1909 to 1937 is a far cry, especially in aviation. But, basically speaking, those 28 years are not so far back, at least so far as aeronautical ideas are concerned.

Hubert Latham, one of the early aeronautical pioneers, was largely responsible for the fame justly given the trim little Antoinette monoplane designed by Levavasseur, the Frenchman. For its time, the Antoinette was a remarkable airplane and still stands out today as a shining example of pioneering in aviation.

In May, 1909, Latham set a world monoplane endurance record by staying aloft in his Antoinette for 37 minutes and 3 seconds. The following month he broke his own record by staying aloft for 1 hour, 7 minutes and 37 seconds. In July of that year he boosted the world's altitude record to 450 feet. Later, he attempted to beat Bleriot across the English channel in an effort to win a substantial prize offered by the *London Daily Mail*.

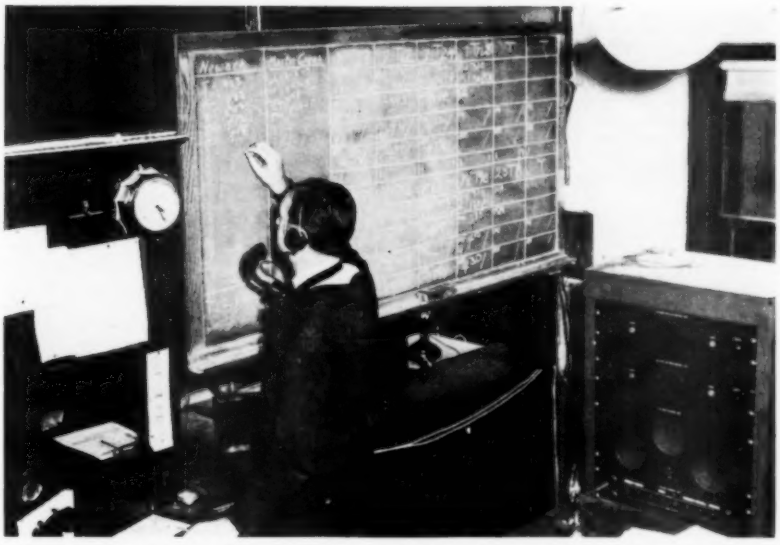
The Antoinette was powered with an Antoinette eight-cylinder engine which, whenever it felt like it, completely ignored the attempts of a worried pilot to keep it running.



Latham is shown above taking off in his Antoinette monoplane. Note the nose skid out in front. Present-day manufacturers are just getting back to three-wheeled landing gear for safety.

Organization of an Airline

by
MYRON EDDY
Director of Stewart
Technical School



The plane movement and airway traffic control board operated by American Airlines, Inc., at the Newark Airport, Newark, N. J. This corresponds with the train dispatcher's board on a railway system.

ANYBODY who runs an airline is called an "operator." An air transport company is called an "operating company." And within every airline company there is a department called "operations."

The operations manager is in charge. The work of his department is both administrative and executive. Orders for all flights originate in the operations department. Communications are part and parcel of the set-up. So is meteorology, especially the handling and dissemination of weather data.

Besides the Flight Dispatcher and the Meteorologist there are radio and PBX operators, typists, clerks, messengers. Each has important duties; each does work absolutely necessary to the successful—and *safe* —operation of aircraft.

This operations staff has grown from year to year. Now, quite recently there has been added the most important man of all: the traffic control tower man. His title has not been definitely decided upon as yet but his job is tops and his work is undoubtedly the most important of any. There is no question about this for crashes have shown us the absolute necessity for control of all flights; and for radio and other communication facilities which make this control easily feasible. With the advent of the control tower the importance of well trained operations personnel, particularly radio men, becomes obvious.

But lack of experience or training on the part of operations men cannot be cited as the sole reason for crashes. There seem to be four different elements which enter into or affect the safety of flying.

1. THE PLANE. There has been no fatal structural failure for years. Long distance flights have repeatedly proved that new engines stand the gaff. It is simply up to the operating personnel to maintain flight equipment up to par or replace it—even if the company doesn't pay dividends —if planes are to be kept safe.

2. THE PILOT. He is about 99% safe. Men have died at the throttle of an airplane; perhaps others have fainted, but barring some far-fetched situation—offset by having both a pilot and co-pilot on every passenger run—the pilot of today is about the safest man who works for a living. He is so much more safe than the average run of the mill we see driving automobiles—and more or less deliberately dodging them—that it's just plain stupid for the layman to criticize our transport pilots.

3. *AND* WEATHER. This represents one of the most uncertain factors of the air game. Since a man cannot be all over the sky at the same time it is not alone enough to know a storm lies to the west, to the north; in turning south to escape he may meet another, not yet reported. Or he may be enclosed from all directions because he has not *wanted* to turn back.

No. Skillful weather forecasting will never be sufficient to safeguard a flyer—a "good" flyer—against his inclination to take a chance in getting through. (Especially when his pay depends on just this.) The more accurately you spot his enemies in the sky for him the more eager he will be to try to dodge them all.

Here, again, a little knowledge is a dan-

The pilot and stewardess are intently regarding the anti-statically sheathed radio antenna in the nose of the airline transport. This ring-form type of loop has accurate directional qualities.

XUM

gerous thing for although a meteorologist can locate a storm, no man can tell what its severity will be at any given spot high in the air. You simply can't fool with old man weather and play absolutely safe but additional ground facilities especially additional weather broadcast stations will cut down crashes.

4. OPERATIONS. We must always have certain man-made conditions imposed on the flight, conditions which add to the risk if flying is to be a gainful occupation. People always have taken risks to make money and they always will. Here we get the first part of the trouble-making elements of operating an airline. To fly straight and fast and on schedule is to make money. To fly and lose money would be considered moronic.

A definite solution for all the problems of an Operations Manager consists of just two things: permission to make safety come first, and *complete* facilities for safeguarding the plane's flight.

These facilities for safety are: (1) radio beacons, (2) radio compasses, (3) radio communication stations, (4) weather stations, (5) intermediate landing fields, (6) lights. The need of these has been definitely demonstrated. The desire for more of them in some cases is pitifully painful. Nothing happens about getting them. Crashes continue at the same places, for the same reasons.

All of these mean a larger, better trained operating personnel. If airline operations are to promote safety—and this is the department to cut down crashes—then more men must be trained as radiophone operators, teletypewriter operators, meteorologists, flight dispatcher and control tower assistants. At the present time these men are mighty hard to find.

Another man who is going to be much in demand and equally hard to find is the aircraft radiotelegraph operator.

It commences to look as if cross country land planes should be navigated from take-off to landing, instead of merely flying a beam as at present because the beam may go bad when the weather and everything else goes bad. Radio compass stations below must be provided to guide the plane after it goes off the beam or the beam (apparently) "quits" due to static. Radiotelegraph will get through when radiophone will not; therefore, radiotelegraph is going to come more and more into use.

With voice-modulated waves, the differences between the high and low pitched notes are too small and gradual to be detected over the violent crackling of static in many cases, hence the radiophone is not well adapted to conditions where positive and precise messages are to be broadcast. The railroads, rich in this wisdom after many years, still employ telegraphers and code to a large extent. It is difficult to find a substitute for "dit-dit-d-a-a-a."

As it is humanly impossible for a pilot to BE a pilot and everything else too, a third man aboard the plane will sooner or later be considered as essential on the transcontinental air lines as they are on Pan American's over-water flights.

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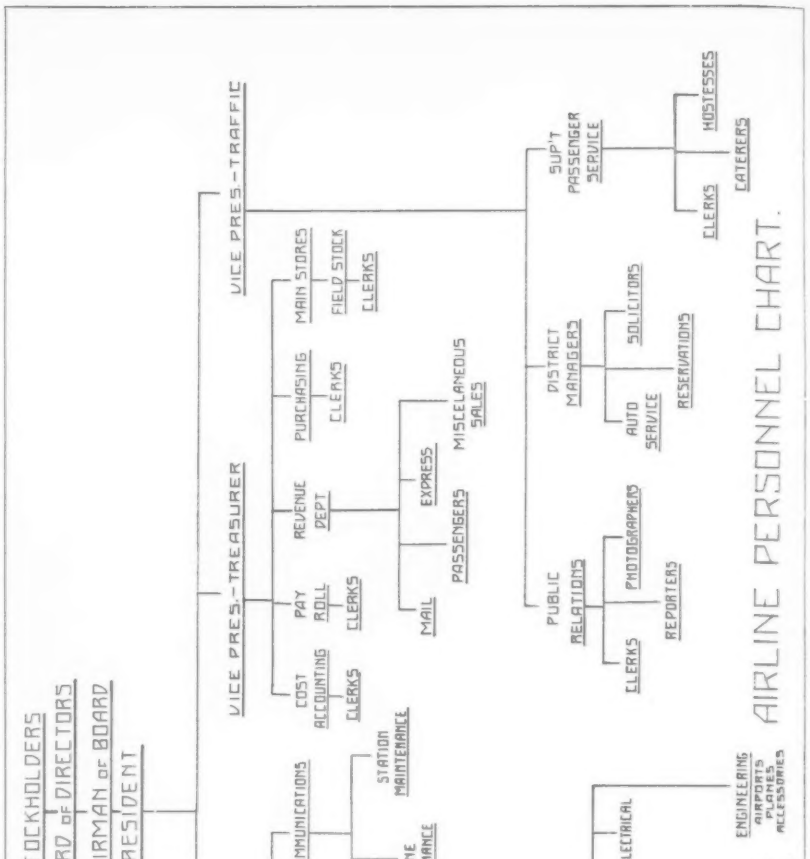


Huge Canadian Airway Project

by HAROLD H. HILLIARD

Mighty plans for the promotion of a complete airway system for our neighbor to the north are now in full swing, and within a short time Canada will have an aerial highway of the first order.

CANADA is on the eve of revolutionary changes in its air services. Within a few months, according to present plans, the Dominion's airways will have advanced from "bush" routes to inter-city channels.

The Transcontinental air mail and passenger service is assured after mismanagement of the Bennett government destroyed first steps in a Trans-Canada service, made in 1930 by the Liberal regime. Whereas today Canadian business men must put 70 tiring hours in on a train to get from Toronto to Vancouver or use American air-lines, on July 1st next it is planned to have an air service established linking Montreal and the Pacific coast over an all-Canada route so that Montreal is put within 15 hours of Vancouver. This will mark an important milestone in the advancement of Canadian aviation as compared to the present services.

Today almost all of Canada's flying is confined to its frontier north country in connection with the development of the nation's vast mineral resources—in fact no other country in the world has developed air services to such an extent in this direction as Canada. In proportion to population the Dominion has led the world for the past ten years in the flying of freight, passengers and mail, the vast majority of which has been carried out in the mining districts. Without comparing proportions of population Canada has, for the past 4 years, carried more freight by air than any country in the world.

Three pilots in Canada, according to government statistics, carried more freight during 1935 than all the air companies in the United States combined. Such items as boilers, tractors, ore buckets, mine cars, heavy cases of mine machinery are as common to a Canadian air operator as a passenger is to United Air Lines in the U. S. A. Contracts for the shipment of as much as five, six or eight hundred tons of freight are becoming monotonously common.

Canada can not be satisfied with laurels won by its air companies in the mining fields, however. With such great distances between the large centers of population, 1,200 miles between Winnipeg and Vancouver, a similar distance between Winnipeg and Toronto, 300 miles from Toronto to Montreal and 600 miles separating the latter point and Halifax, a method of quick contact is a necessity and not a luxury as some Canadians—in fact most Canadians—would have it believed.

The United States has demonstrated the advantage of a transcontinental service to contact coast with coast in a matter of hours and such a service in Canada will have, in addition to advantages for business men, many other points in its favor,

Exploration planes resting on the waters of a Canadian lake are the advance agents of a new regime in Canadian aviation.

not least important of which is the fact that Canadians will be, as a nation, drawn much closer together. Thoughts of the west breaking from the east still smolder in the minds of some Canadians due to that great barrier, sparsely populated North-Western Ontario, which lies between Eastern Canada and the Western Provinces.

The establishment of a coast to coast airway will probably bury such agitation forever as Montreal will then be almost as close to Vancouver as it is now to Toronto. Winnipeg will be only seven hours from Toronto. A Trans-Canada air service is definitely going to make revolutionary changes. Aviation itself will become a very important industry while the effect on other industries will likewise be important.

The Industrial Development Board of Manitoba forecasts an industrial boom in Winnipeg and other Prairie cities when this service comes as many Eastern firms, held back by the inability of executives to keep close supervision on Western branches owing to the great distance from Head Office, are now planning to establish in the West when assured of close contact between Head Office and the branches by the airways.

At time of writing, more definite steps toward the establishment of a Trans-Canada service than ever before were being taken by the Dominion Government. Hon. C. D. Howe, Minister of the new Transportat Department, was energetically at work months before the Department was organized in the establishment of the inter-city air service. His most recent announcement is to the effect that, on July 1st, Dominion Day, 1937, a daily Montreal to Vancouver schedule will be placed in operation.

The Montreal-Halifax division, 600 miles long, will be established just as soon after July 1st as possible; then Pacific coast will be within 18 hours of the Atlantic although the distance separating them will be 3,000 miles. Distances will no longer be measured by miles but rather by hours as is now the case in the north country. There are still many Canadians who will take years to be convinced that such a service is possible and dependable but other nations have demonstrated the necessity of air services and, to keep pace, Canada must expand its air lanes.

Much work has already been done and much more must be done this winter before everything is set to send the giant liners out from Montreal next July on their over-night trip to Vancouver. Before the facilities are complete there must be emergency landing fields every 25 miles across the Dominion—120 fields in all. With the exception of the division from Hearst to the Manitoba boundary in Northern Ontario these fields are practically all ready. Fifteen of the 23 fields in Northern Ontario are available for use while the remaining 8 will be completed during the coming year. First work on the Northern Ontario fields was completed by relief camps established during the Bennett regime. Men were paid 20c per day, their board, room and clothes. When the King administration took over reigns of office in 1935 the system was changed and now men are receiving 35c per hour to prepare these fields.

Radio and beam facilities will be installed at intervals of 125 miles along the Trans-Canada route. Installation has not yet started although, on the Prairie between Winnipeg and Lethbridge, some of the facilities are available from a Prairie Air Mail Service started in 1930 and continued until 1932. The prairie facilities must be modernized while all new equip-

ment is to go into the other fields. This is soon to be ordered while, as far as the actual installation is concerned, this can be done at short notice.

Hangars are to be located at intervals of 400 miles at strategic points from coast to coast. Construction of these has started. Some are already completed. Officials of the aviation branch of the Dept. of Transport are confident that all the landing fields, hangars and other facilities will be ready for the Transcontinental service by July 1st. Rehabilitation of the Prairie section can be carried out quickly.

Portion of the transcontinental route which is causing greatest concern is from Lethbridge, Alberta, across the rockies to Vancouver. Tests for the air service over the mountains were being made at time of writing by Squadron Leader J. H. Tudhope, Dept. of Transport, Ottawa. The plane being used was a giant Lockheed-Electra monoplane piloted by Air Commodore Herbert Hollick-Kenyon who made the famous flight to the South Pole with Lincoln Ellsworth last winter.

The machine has been fitted out as an experimental radio laboratory and, from it, tests are being made with a mobile ground unit of motor lorries managed by a crew of 12 men. The mobile units, each containing their own radio broadcasting and receiving sets, are being driven through the mountains. Broadcasts are being carried on with the test plane flying overhead and, by this method, it will be ascertained at which points reception is clearest and favorable for the establishment of a radio direction station.

The last important step towards establishment of the Trans-Canada service is the organization of an air corporation to operate it. This question will be one of the major issues before the present session of the House of Commons. It will probably be early in the New Year before a definite decision as to set-up of the corporation is decided upon.

The likely set-up will provide for the organization of a $5,000,000 corporation in which the government will own 25 percent. interest and the two principal railway systems, Canadian National and Canadian Pacific, each 15 percent. The remaining 45 percent. will be divided amongst the private air companies of the Dominion, principally Canadian Airways which has pioneered in the development of aviation in the nation.

Another suggested plan for the set-up is that the corporation would not be controlled by the government but, instead, the two railways and Canadian Airways would each have 33⅓ percent. interest. This would give the government one-third interest through the Canadian National Railways which is government-owned.

Such problems as the securing of pilots and planes will be dealt with as soon as the new Corporation is set up. It is considered likely that, at first, the 10 passenger Lockheed-Electras with cruising speed of 180 miles an hour will be used on this service to carry mail and passengers. At first 5 machines will be used, 2 for regular service and 3 as spares. When the busi-

(*Concluded on page 59*)

No Cold Noses for the Air Corps

This Northrop attack ship can operate in even the coldest subzero temperatures through the use of the air corps' newly perfected pre-heating tents. A special heater concentrates, through use of the tent's retaining walls, on the engine's oil supply.

ONE of the biggest assets of the United States army air corps in future wars will be that body's ability to operate under any and all conditions—and anywhere.

Of all bad-weather operations, the air corps' chief handicap has been the extreme sub-zero weather experienced in the northern sections of the country.

After extensive experimentation during the course of both special mid-winter flights as well as air corps maneuvers in the northern states during the periods of freezing temperatures, the special airplane nose tent shown in the above photograph was adopted. In this tent not only can the engine heater be operated, but the mechanic can work with a certain amount of shelter from the elements.

Previous experiments with hoods and heating boilers have been discarded in favor of this new design.

So that this mechanic can do his work with a degree of shelter the new tent shown above is used.

New Trans-Atlantic Air Base

TRANS-ATLANTIC airline operations by Pan American Airways System and Imperial Airways are to open soon under a joint Anglo-American agreement.

In return for the use of British-controlled facilities at Newfoundland, Bermuda and the British Isles themselves, the American company was forced to enter into an agreement with Imperial Airways whereby both companies now will operate the line. This agreement was entered into about a year ago.

For many years a comparatively unused New York airport, North Beach soon will serve as terminal for one of the most important airline ventures of the century.

Some Tips on Control Design

by RAOUL J. HOFFMAN

Here the amateur homebuilder and designer will find some exceedingly useful material, on the design and construction of controls, that has never before been published in an aeronautical magazine.

DESIGNING controls constitutes half the design of a whole airplane.

If offers a great scope for inventive minds to compromise between simplicity and cost of various combinations of levers and connections and to decide between angular and linear motion. As a result, it is no surprise that controls seldom fit into an experimental plane without interference from cargo, passengers or structure.

Nevertheless, an easy way to save time and to prevent errors is the building of a "mock-up" or full size model of the intended airplane. An illustration shows a mock-up of a small experimental plane built of ¾-inch square sticks (kindling wood) connected with plywood gussets, glue and small nails; the rigidity of the frame is depending on the holding power of the blue joints.

A mock-up not only reduces time for designing controls, but also aids to determine the vision from the pilot's seat, and helps to simplify some of the structural connections. It is a decisive factor in the quality of the design relative to safety, accessibility and strength.

The Department of Commerce specifies certain requirements for the control system, part of an approved type certificate (A. T. C.). The strength requirements are based upon the applied loading on the control surfaces and an added factor of safety of 1.5 gives the design load.

The load conditions for the stick or wheel and two scales for reducing computations are noted on accompanying chart. Forces created by the loading of the controls and affecting the primary structure must be included in the respective stress estimate.

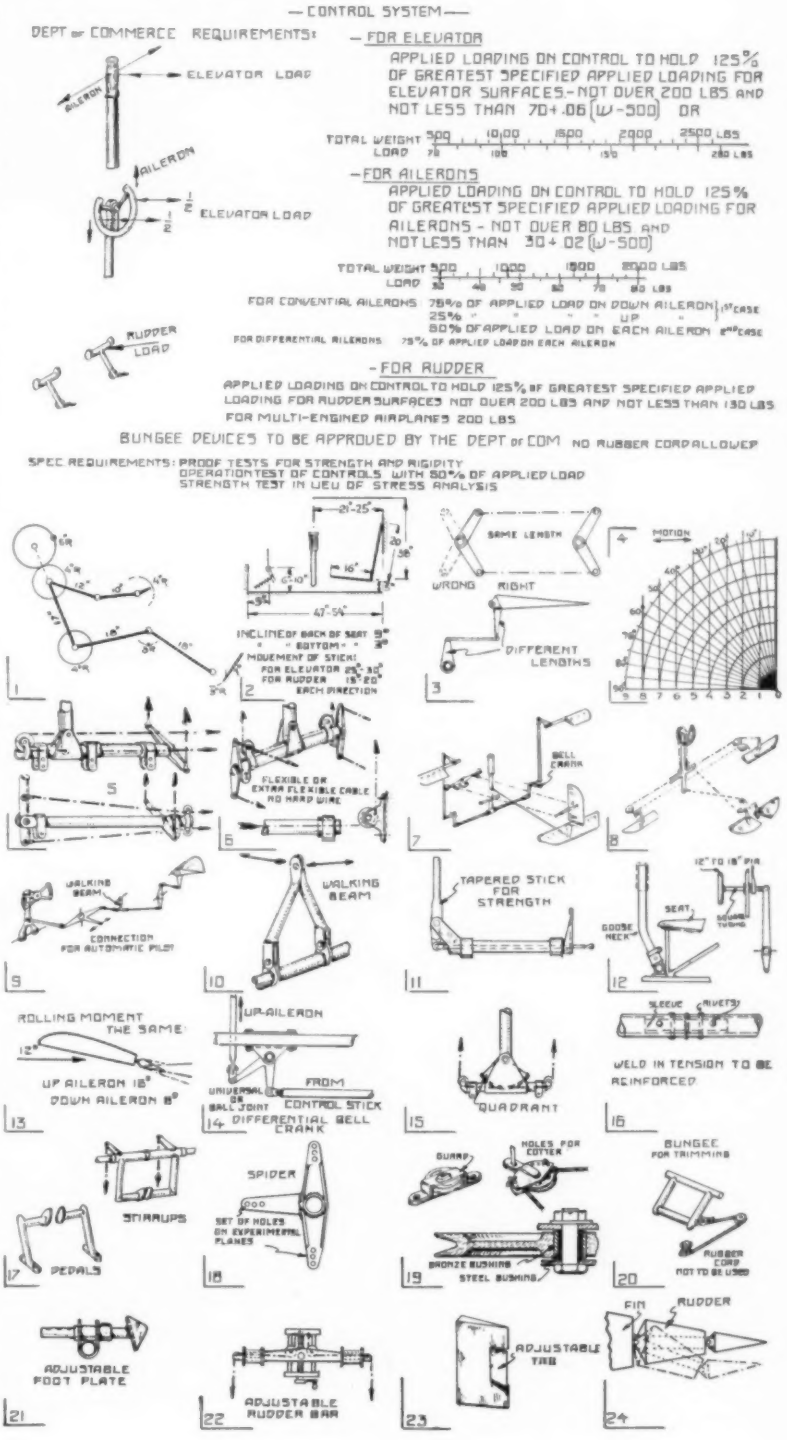
Controls must have, in addition to their required analysis, a proof test for rigidity and strength in presence of a Department representative. The test is to include all fittings, pulleys, and brackets used to attach the control system to the primary structure.

The proof test is to last for the period of one minute, with no permanent set permissible. Then, an operation test is required with 50 per cent of the applied load on the surfaces not to be less than the corresponding minimum load on the control column.

But the Department will accept strength tests in lieu of a stress analysis if the load is carried to 125 per cent of the design load. Permanent set is permissible in strength tests providing that the structure supports the required loading before failure.

All controls are to have stops, located not too close to the hinges, which positively limit the range of motion of the control surfaces.

Bungee devices, or means for maintaining a pressure or pull on the controls, are only allowed if the airplane flies satisfactorily



without them. Years ago they were extensively used to provide pressure upon the rudder bar to overcome the tendency to yaw (See Sec. 20), relieving the pilot of discomfort. Discomfort was then usually the cause of short duration flights.

The pilot's comfort will always be the main requirement for a correctly designed control system. It is obvious that the height of the pilot will influence the general dimensions of the control, and in case the design of the pilot compartment was not determined from a mock-up the dimensions in Sec. 1 and Sec. 2 will suffice for a preliminary layout, if extra space is provided for a cushion or a parachute.

The design of a subassembly unit, that will include all three controls mounted on a frame to be placed into the structure, should prevent a possible jamming of controls after taking to the air and should be a unit for mass production; even if only the two controls with their bearings would constitute a unit assembly outside the machine will simplify manufacture. One design was attempted years ago which included the seat with its adjustment, the retractable radiator column and all controls mounted on a frame with a three point suspension.

Controls and control surfaces are connected by torque tubes, push rods, cables, levers (single or double), bell cranks, spiders, quadrants, pulleys, walking beams or other force transmission mediums such as compressed or rarified air. Usually all motions are interconnected angular motions, their magnitude depending on the relative lengths of the lever arms.

In case cables are used the lengths of the lever arms must be the same, and their radial lines must be parallel (Sec. 3). If the lengths vary or the motion be reduced or reversed, push rods should be employed. Very often cables are used up to the control surfaces and then followed by push rod to pass through a narrow space. Push rods should be in preference to crossed cables, pulleys or friction pads.

If the motions of the links (lever and rod) are in the same plane, a single bearing may be used; but if they move in different planes, use a universal joint, or if a torsional motion is present then employ a ball joint or a sleeve bearing. Universals must have ample dimensions to prevent eccentric loading. Loose pin connections do not make a universal.

The angular movements of controls and control surfaces are from 15 to 25 degrees, and their connected parts have a linear motion of 3 to 44 per cent of the arm

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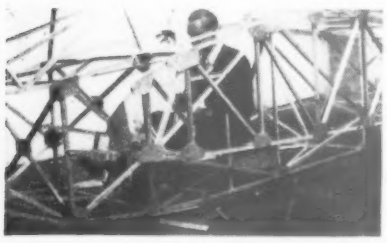
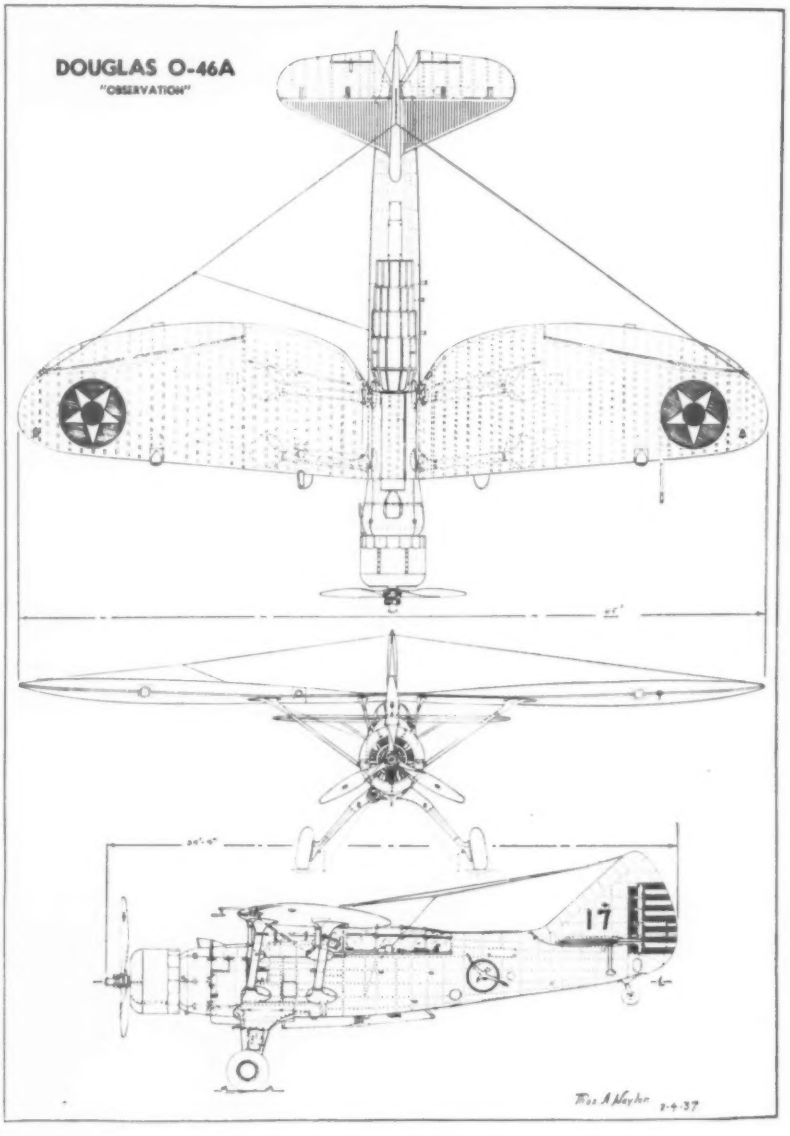


A "mock-up" made of wood in which the control position can be tested.

Plans of the Douglas Type O-46A

These scale drawings are the second in a series of plans by Thomas A. Nayler, which show the parts and relation of the parts very clearly. The photo is the Official Photo of the U. S. Army Air Corps.

Three-quarter front view of the Douglas Type O-46A, in which the curved trailing edge is clearly shown.



Revealing the Geodetic System

by BENET NICHOLLS

In response to requests by many of our readers, we are printing the following interesting description of the Geodetic system of construction, which, it will be seen, is not entirely a new conception.

Fig. 1.

A curved beam under compression will buckle up into the form indicated by the dotted lines.

IN RECENT years there has been a marked tendency among aircraft designers to concentrate on the monoplane in preference to the biplane design.

Modern practice has shown that a well designed monoplane can be made superior in every respect to the biplane, with the exception of maneuverability. Since, however, higher top speeds have been attained by means of cleaner acrodynamic design and increased power output of engines, maneuverability has been relegated to a minor position through the effects of g or force of gravity on the occupants of the machine.

Even in the matter of landing speed the monoplane rivals the biplane. This fact is due to the introduction of such devices as trailing edge flaps.

Much has been done also to reduce interference drag, i.e., drag due to the proximity of certain components, such as wing and fuselage, which is greater than the sum of the two separate drags.

There remains, however, one serious obstacle to be overcome before the full efficiency of the monoplane design can be developed. The reader is no doubt familiar with the fact that high aspect ratio results in low induced drag, and hence all-round efficiency can only be obtained by employing a high aspect ratio. High speed can be obtained with low A.R., but good take-off, rate of climb and ceiling demand a high A.R.

It is also important that the ratio of wing thickness at the root is not too great a percentage of the wing chord. Engineers are fully aware of the difficulty of combining a high aspect ratio with a relatively thin wing in the cantilever type of wing construction. Since the bending moment increases greatly with span and "thickness," the limit is very quickly reached with ordinary forms of construction, if structure weight is to be kept down to a reasonable figure.

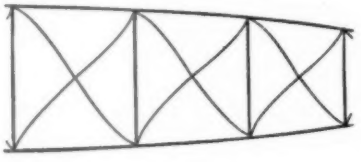


Fig. 5.

Conditions in the ordinary strut truss type fuselage.

In the past few years, great progress has been made by Amerian designers in the so-called stressed-skin construction. A thin sheet of metal has very little strength when submitted to compressive loads, and tends to buckle long before the real strength of the material has been developed.

If we take a sheet of paper and bend it into the form of a tube, it can support a considerable weight endwise, although in its original sheet form it has practically no strength in compression.

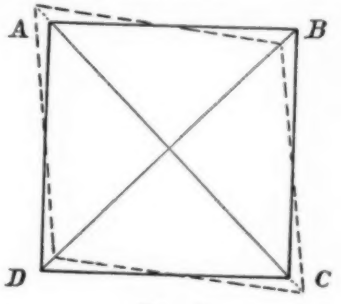


Fig. 3.

A square fuselage section (A-B-C-D) will distort without stays under torsion.

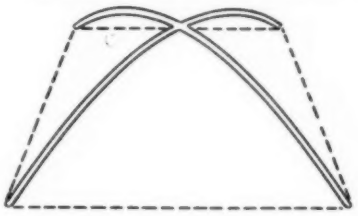


Fig. 4.

Two curved beams oppose each other.

Again if we corrugate the paper and bend it into the form of a corrugated tube its strength is still further increased. This is the principal employed in the use of stringers and frames by designers to reinforce stressed-skin constructions.

Several methods of reinforcing the stressed-skin have been evolved, yet in spite of these, even when the stringers and frames form comparatively small panels nothing like the full strength of the material is developed.

Consequently it has been found necessary to use a heavy gauge metal in the construction with a consequent increase in structure weight. Since failure in stressed-skin covering is due to diagonal compressive loads, it occurred to Mr. B. N. Wallis of Vickers Aviation Ltd. to employ the stressed-skin construction in the concentrated form of bars and tubes. Thus the geodetic construction was evolved.

Fig. 2.

When subjected to tension stresses, the curved beam will display a tendency toward straightening.

To understand the principles involved, let us consider Figure 1. When a curved member is submitted to a compressive load, it tends to close up its two ends and to still further bow in the center. Its strength is only a fraction of what it was when the member was straight.

Consider for a moment the case of the ordinary wire-braced fuselage. Figure 3 represents a single bay ABCD. When the fuselage is twisted it can only "give" by one of the bracing wires going slack and the other stretching. Thus, the bay takes the shape of a rhomboid as shown by the dotted line.

Suppose we intend to substitute two curved members of the type shown diagrammatically in Figure 1. Figure 2 shows what happens to a curved member in tension; the ends tend to draw out and the center to drop. In other words it tends to straighten out.

Each of these two members is itself totally unsuited to the work required of it. But, if we anchor the two centers together as in Figure 4 they will tend to oppose each other. The tension member cannot straighten out because it is held by the center of the compression member.

Similarly the compression member cannot bow because of the tendency of the tension member to straigthen out. This is the whole crux of the geodetic principle. The diagonals work against each other and bending loads in them are thus reduced to zero. Hence it is possible to use a very light gauge of metal in their construction.

The geodetic system itself, however, is

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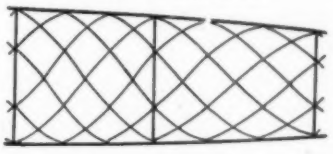


Fig. 6.

Here we have the helical member of the geodetic fuselage.

What Our Readers Are Building

Mr. Foster's little seaplane is based on the lines of old "Jenny." Note the nose of the plane.

Karl D. Klinedorf built himself this nice little "Longster" and reports it "O.K.".

Johnnie Bunting built this fine little plane which is powered by three cylinders from a LeRhone.

WELL, here we are again with a lot of hot ships constructed by our readers—swell jobs that you will admire and desire to duplicate.

While the aerodynamic experts are pushing slide-rules and splitting infinitesimal hairs, our good old amateurs with their saws and hammers are smacking them together and are doing a little real flying. And the best part of the whole matter lies in the fact that the number of crashes is almost negligible and, when the boys do crash their ships, there is seldom a fatality. State aviation boards please note.

First on the exhibit is the swell little seaplane built by H. C. Foster, Vanport, Pa. Very unfortunately, the authorities put their big feet down on this little plane and grounded it, but that has nothing to do with its excellence. This rather calls to mind, however, that there have been quite a number of licensed passenger transports crashing with ultra fatal consequences, but of course this is perfectly all right so long as the accidents are legal and according to the rules.

Mr. Foster's design follows the outlines of old Jenny—an amateur Jenny on floats. The resemblance can be seen clearly in the accompanying photo which was sent to us by Mr. Foster. One glance at the wing cells tells us that it would take considerable slamming to overcome the rigidity of this well braced wing construction.

Second on the list is the Longster built by Karl D. Klinedorf, 590 Hayes Street, Gary, Ind. It is powered by a E107A Aeronca engine and has a fuselage of the DeHavilland wooden type. The ship was test-hopped last September 20th, by Hugh Gamble, who found it to be O. K. except for a few minor adjustments. This is a nice looking job. Mr. Klinedorf says that Les Long was very generous with his advice and help during the construction of the ship, and the builder further states that he gives POPULAR AVIATION a vote of thanks for its many useful and inspiring articles on lightplanes.

Next comes Paul A. Ruebush, 542 N. 109th St., Seattle, Wash., who sends in photos of his lightplane which was designed and built by Johnnie Bunting, Bothell, Wash. This is really a homemade job in every detail for the three-cylinder radial engine was converted from an old wartime LeRhone rotary; the prop was made at home and also the oleo-type landing gear struts.

Now for the shock. This ship was built by Johnnie Bunting more than five years ago, but his modesty and diffidence kept him from sending in the photos himself. It was up to his friend, who bought the ship, to give publicity to the job and so here we are with a fine performing ship, 100 per cent home-built, that has survived the racket for five years and is still on the job.

Johnnie Bunting taught himself to fly in this ship without any previous experience. It has a top speed of 95 m.p.h., cruises at 80 m.p.h. and lands at 32. Just at the present, the ship is grounded under the laws of Washington state, but the owners are hopeful that the Private Flyers Association of Oregon will have the present laws changed. A local chapter of the P. F. A. is being organized in Seattle at the present time.

This stunt of making over an old LeRhone is sure a novelty. I have heard of attempts in this direction before but this is the first time that we have heard of the idea blossoming out into a reality. Congratulations, West Coast Boys — you're good.

Albert V. Forman, Route 1, Box 196, Medford, Ore., is next in line with his home-built ship. And now for another interesting announcement—it is home-built and licensed under the new and sane laws of Oregon! But there is still more to come.

Mr. Forman soloed in a Taylor Cub in two and one-half hours which automatically makes him a member of our "Quick Solo Club." Upon the completion of the fifth half-hour, he climbed out and started building the lightplane shown here, which is sure a record. After the lightplane was finished, he test hopped her for half an

in the Line of Lightplanes

hour without difficulty of any kind, so that the last half of his third solo hour was completed in a ship built by himself. Boy, bring in a medal.

On the second flight, he encountered his instructor in the Taylor Cub, flying at the same altitude. When Forman raised his goggles so that his instructor could recognize him, the instructor's face registered horror and consternation, in fact this was such a prominent exhibition of terror that Forman began to wonder if he should have asked the instructor's permission before taking off.

Up to date, the little ship has flown 15 and one-half hours with practically no trouble and it will fly itself for a considerable length of time—hands off.

Robert S. Wong, Vancouver, B. C., now makes a claim on our attention with his Pietenpol Sky-Scout. Bobby Wong is a 17-year-old Chinese student in attendance at the Vancouver Technical High School, who had no actual aviation experience before he began the construction of the plane. He worked on it during the summer vacation and on Saturdays when school started in the fall.

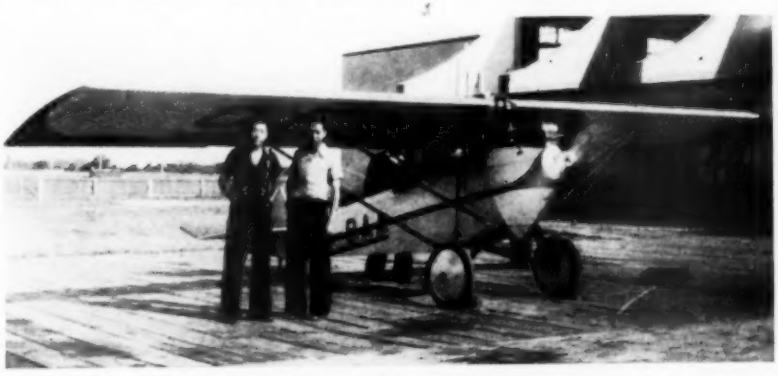
It was inspected before covering by Flight Lieutenant Johnson who gave it his O. K. and also the Canadian registration number CF-BAA. It was then rigged up and test-hopped by Foggin, a commercial pilot who jumped her straight up to 1,500 feet. On landing, unfortunately in a very rough field, some damage was done to the landing gear which is being repaired. We thank his friend Howie Byng for the description and photo.

Goodwin Carlson, Slayton, Minn., built this remarkable little ship which cost him only $300. He has flown it 300 miles cross-country from his home and to date has run up about 50 hours on it. This is his second construction job, and she is still flying. Very unfortunately he gives no other de-

(*Concluded on page* 65)

DEAR READERS. While we have a considerable amount of material on hand for this department, yet we may run short after a few issues. To keep this column going full tilt, means that you should send us a picture of YOUR SHIP. It is up to you fellows to keep this department running.

And here is the lightplane built by Albert V. Forman, LICENSED in the State of Oregon. He is also a member of the "Quick Solo Club".



Robert S. Wong (right) built this fine Pietenpol which, many say, is as fine as a factory job.

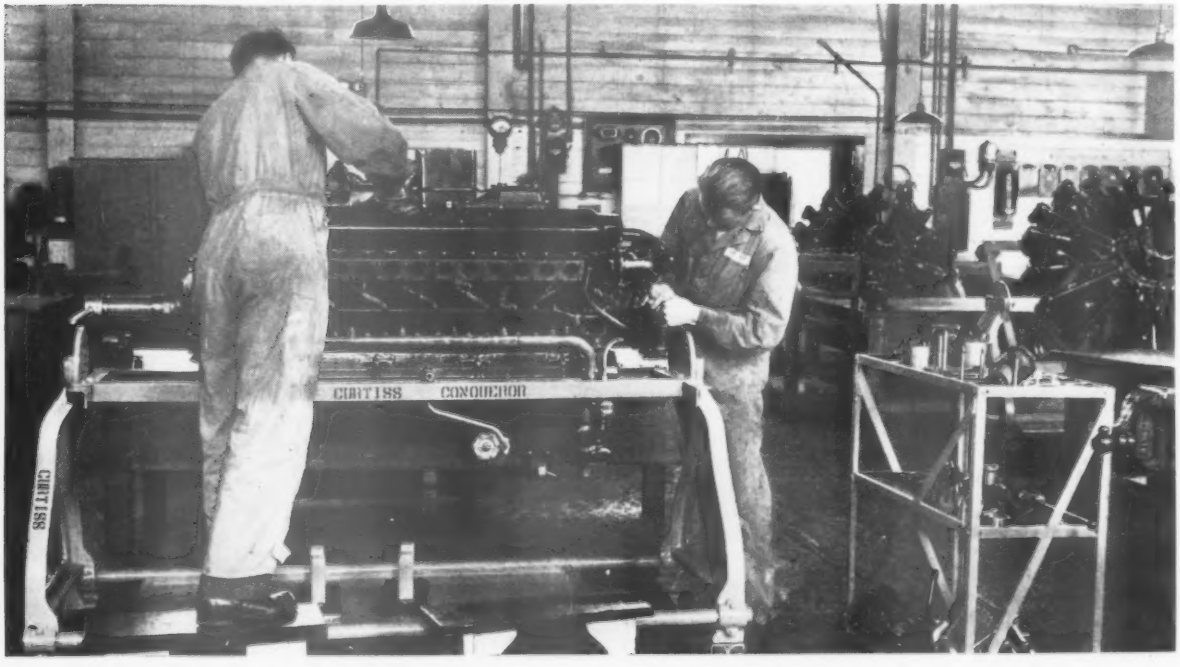
Another view of the Carlson ship with its wings folded.

Last, but not least, is the home built and designed plane of Goodwin Carlson, which cost him only $300.

Chanute Field, Technical School

When the U. S. Army Air Corps sends a student to Chanute Field at Rantoul, Ill., that student returns to his home an expert. These two views show the engine mechanics department of the army's famed base.

On these test blocks both students and experts help work the "bugs" out of airplane engines about which the army wants to know more. Engines are run at idling and wide-open speeds on these blocks for many hours in tests so exhaustive that only the best equipment can stand up under the strain.



Two Chanute Field students are shown dismantling a Curtiss Conqueror engine. In the background can be seen a Pratt and Whitney and a Wright radial engine. Students, before graduating from this school, must be experts both on radial and in-line engines.

Building the Boeing XP—940

by
PAUL W. LINDBERG
Model Editor and Designer
for POPULAR AVIATION

This is the completed model of the Boeing XP-940 job which appears on the front cover.

THE Boeing XP-940 was developed for the U. S. Army Air Corps as a single seated pursuit fighter. All data in regard to speed and so forth is kept a secret by the Army Air Corps. You will find the model to be a very speedy flyer. Then, if a great deal of time is spent in applying the details and so forth to the model you will be repaid with a very attractive display model.

COLOR SCHEME

Entire fuselage army blue with necessary striping. Wing and tail surfaces, army yellow details in black and silver, other color notes are indicated on the plan.

CONSTRUCTION OF FUSELAGE

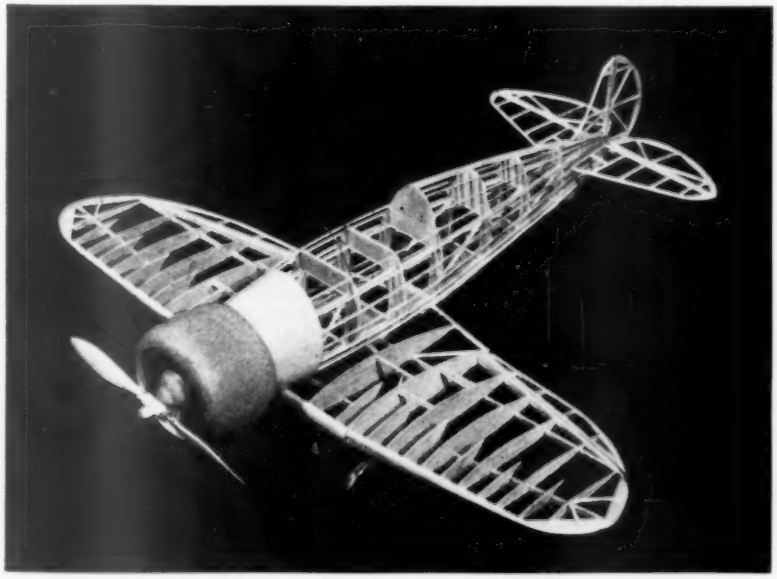
It is necessary to place a sheet of ordinary wax paper over the plan to prevent cement from sticking to it. In building the fuselage, construct one side at a time. The longerons, vertical and diagonal braces, etc., are held in place until securely cemented, by inserting straight pins on either side of strips.

After the two fuselage sides are completed, they are pinned to top view of the plan in such a manner that the top longerons face down and the sides are at right angles with the table. The crossmembers are now cemented in place, forming a rectangular fuselage.

Cut formers from 1/16 inch sheet balsa and cement in their respective positions as shown on plan.

Balsa nose plate is built up from 1/8 inch sheet balsa. Stiff paper is required between nose plate and formers.

The cylinders are carved and sanded from balsa blocks. When nine cylinders have been formed, wind heavy thread around them to represent fins. Make crankcase from two pieces of balsa. Rocker arm housings, push rods and other small details of motor are made of balsa.



The framework of the model Boeing XP-940 before covering. Use this photo in connection with the drawings.

CONSTRUCTION OF WINGS

Cut all ribs from 1/16 inch balsa. Pin the spar in position on the plan. Now cement ribs in their proper locations. The leading and trailing edges are cut and sanded to shape and cemented to the ribs.

The panels carry movable ailerons which are a great help in controlling the flights. Make wing tips from 1/16 inch thick balsa. We highly approve of this type of wing tip, because it is much easier to construct and neater in appearance.

CONSTRUCTION OF ELEVATOR AND RUDDER

These are built from 1/16 inch square and flat balsa, and are constructed on the plan. Their construction is very simple; therefore no difficulty should be encountered here.

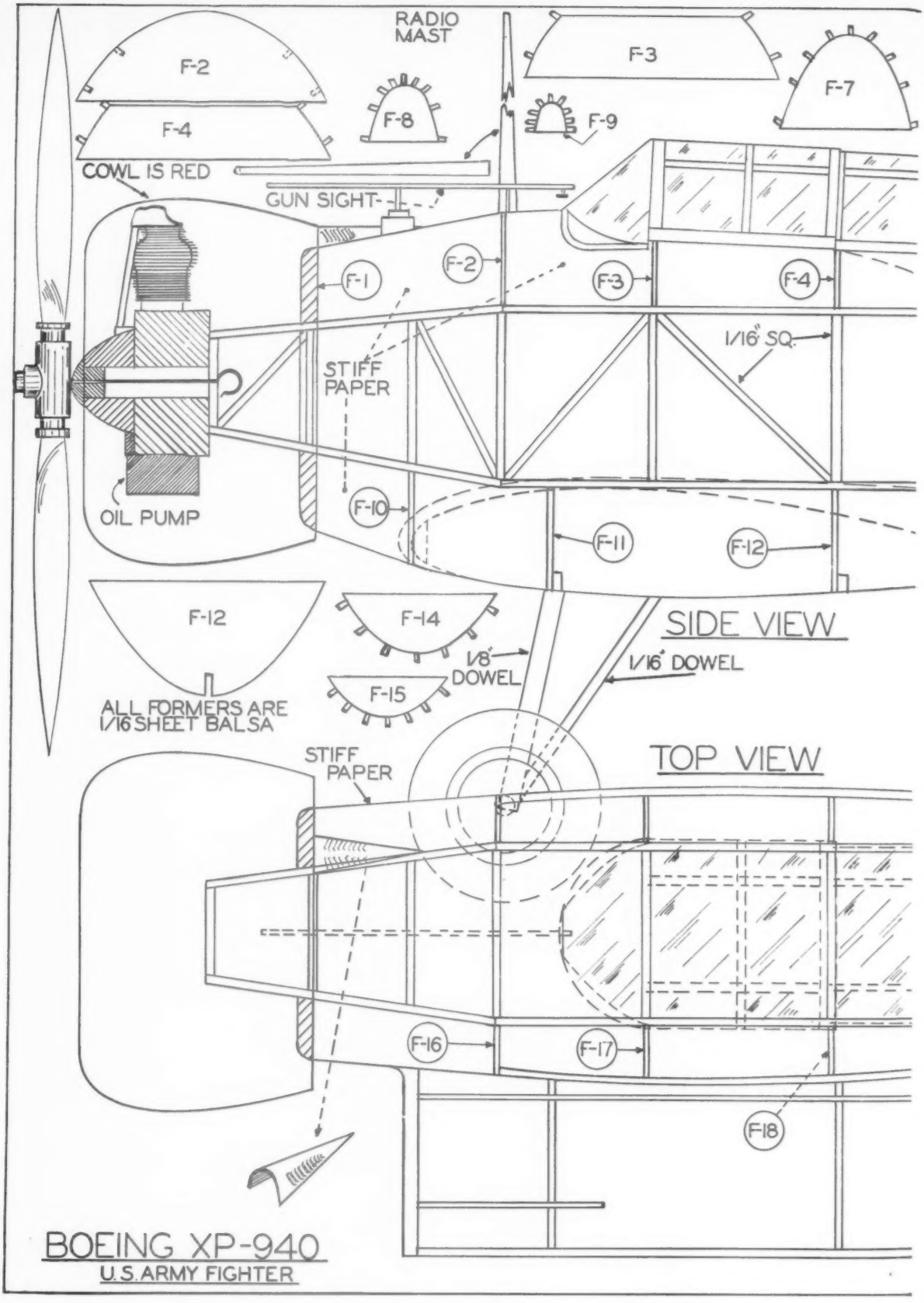
CONSTRUCTION OF LANDING GEAR

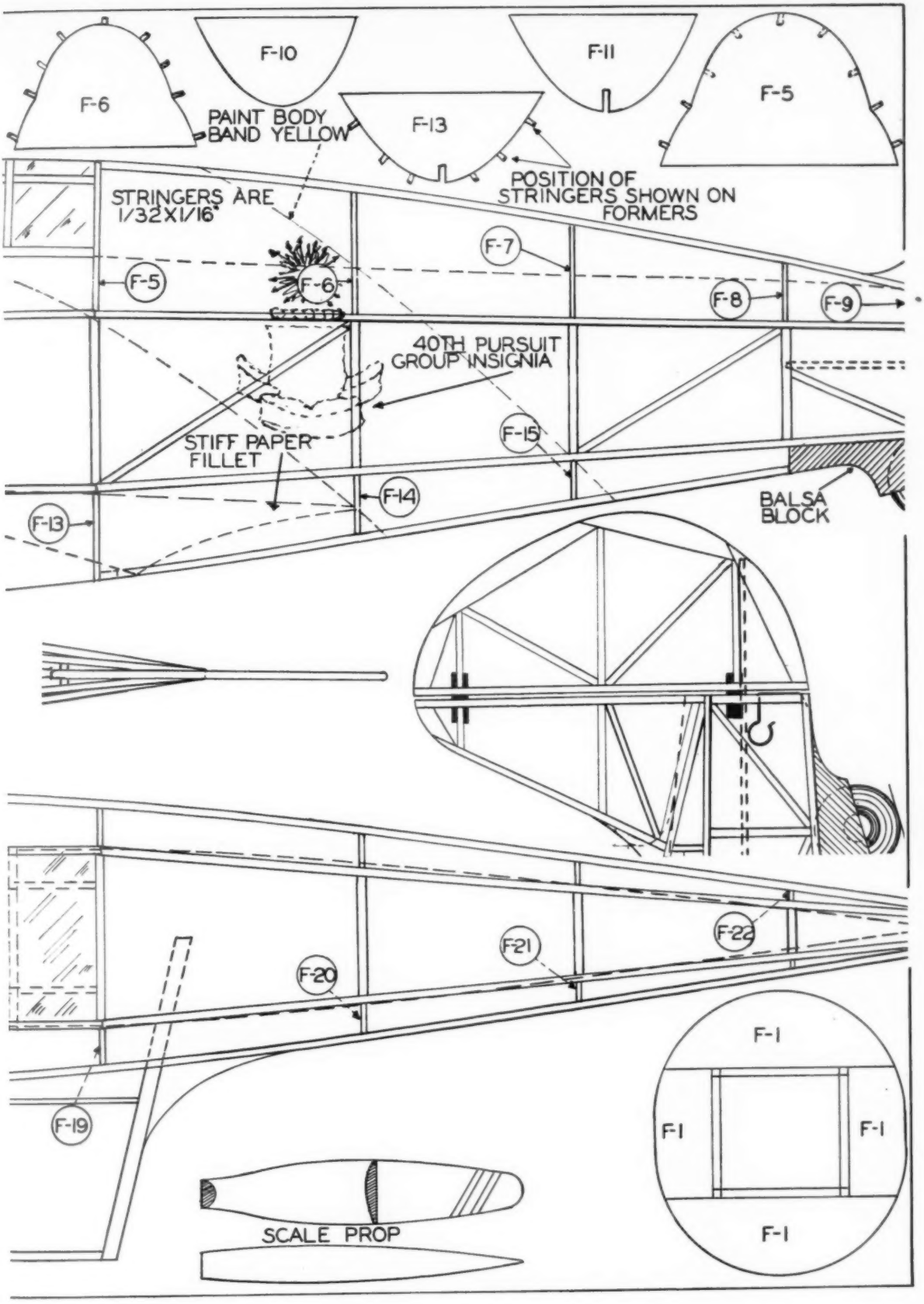
Study plan carefully to clearly understand the construction of landing gear. The method in which the landing gear struts are attached to the wings is plainly described.

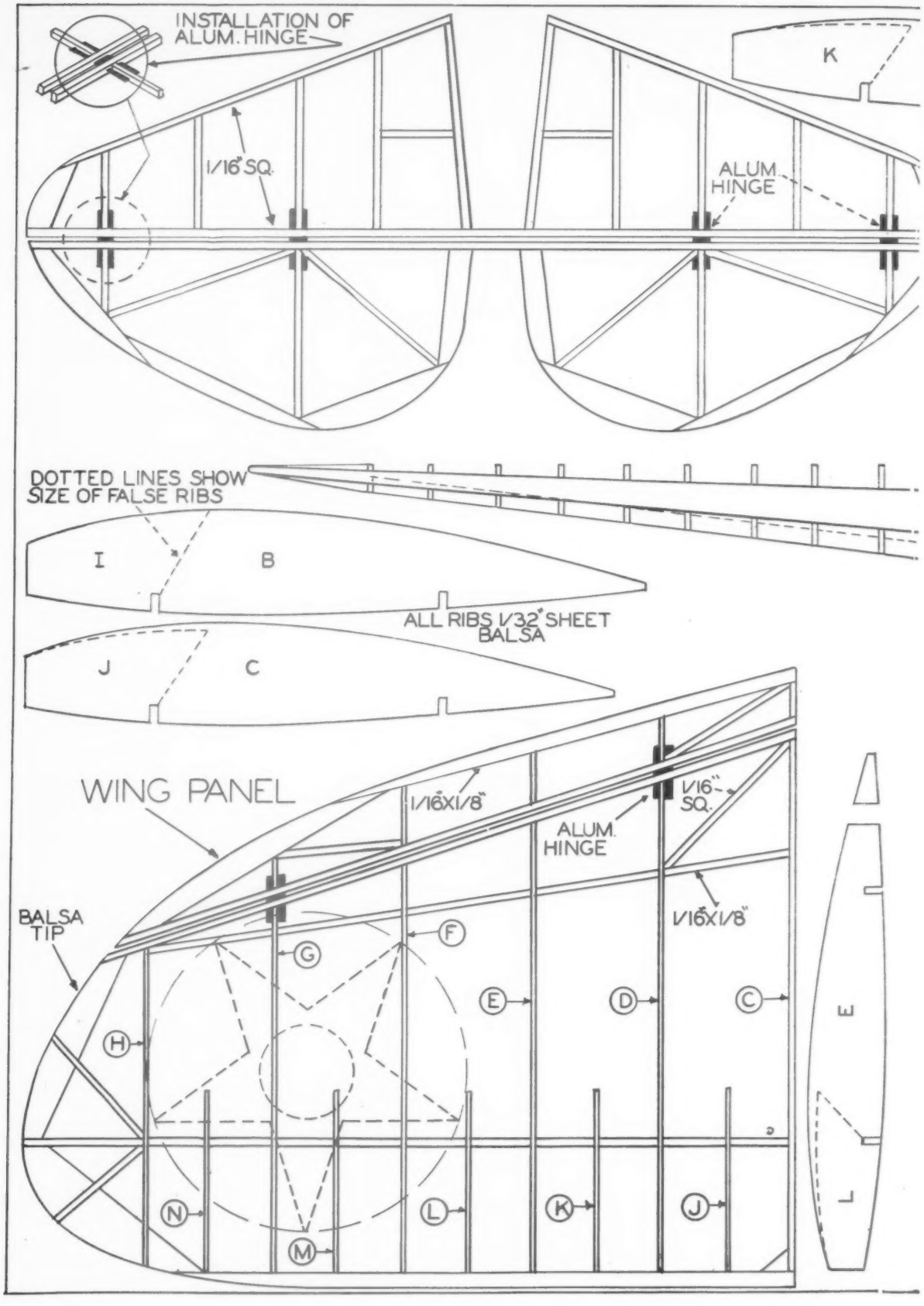
COVERING THE MODEL

Apply tissue to the various framework members, using a light grade model airplane dope to fasten it to the outer edges.

XUM


RADIO MAST
F-2
F-4
F-8
F-3
F-9
F-7
COWL IS RED
GUN SIGHT
F-1
F-2
F-3
F-4
1/16" SQ.
STIFF PAPER
OIL PUMP
F-10
F-11
F-12
F-12
F-14
F-15
1/8" DOWEL
1/16" DOWEL
SIDE VIEW
ALL FORMERS ARE 1/16 SHEET BALSA
STIFF PAPER
TOP VIEW
F-16
F-17
F-18
BOEING XP-940
U.S. ARMY FIGHTER


F-6
F-10
F-11
F-5
F-13
PAINT BODY BAND YELLOW
POSITION OF STRINGERS SHOWN ON FORMERS
STRINGERS ARE 1/32X1/16"
F-7
F-5
F-6
F-8
F-9
40TH PURSUIT GROUP INSIGNIA
STIFF PAPER FILLET
F-15
F-14
F-13
BALSA BLOCK
F-21
F-22
F-20
F-19
F-1
F-1
F-1
F-1
SCALE PROP


INSTALLATION OF ALUM. HINGE
1/16" SQ.
K
ALUM. HINGE
DOTTED LINES SHOW SIZE OF FALSE RIBS
I
B
ALL RIBS 1/32" SHEET BALSA
J
C
WING PANEL
1/16"X1/8"
1/16" SQ.
ALUM. HINGE
1/16"X1/8"
BALSA TIP
F
G
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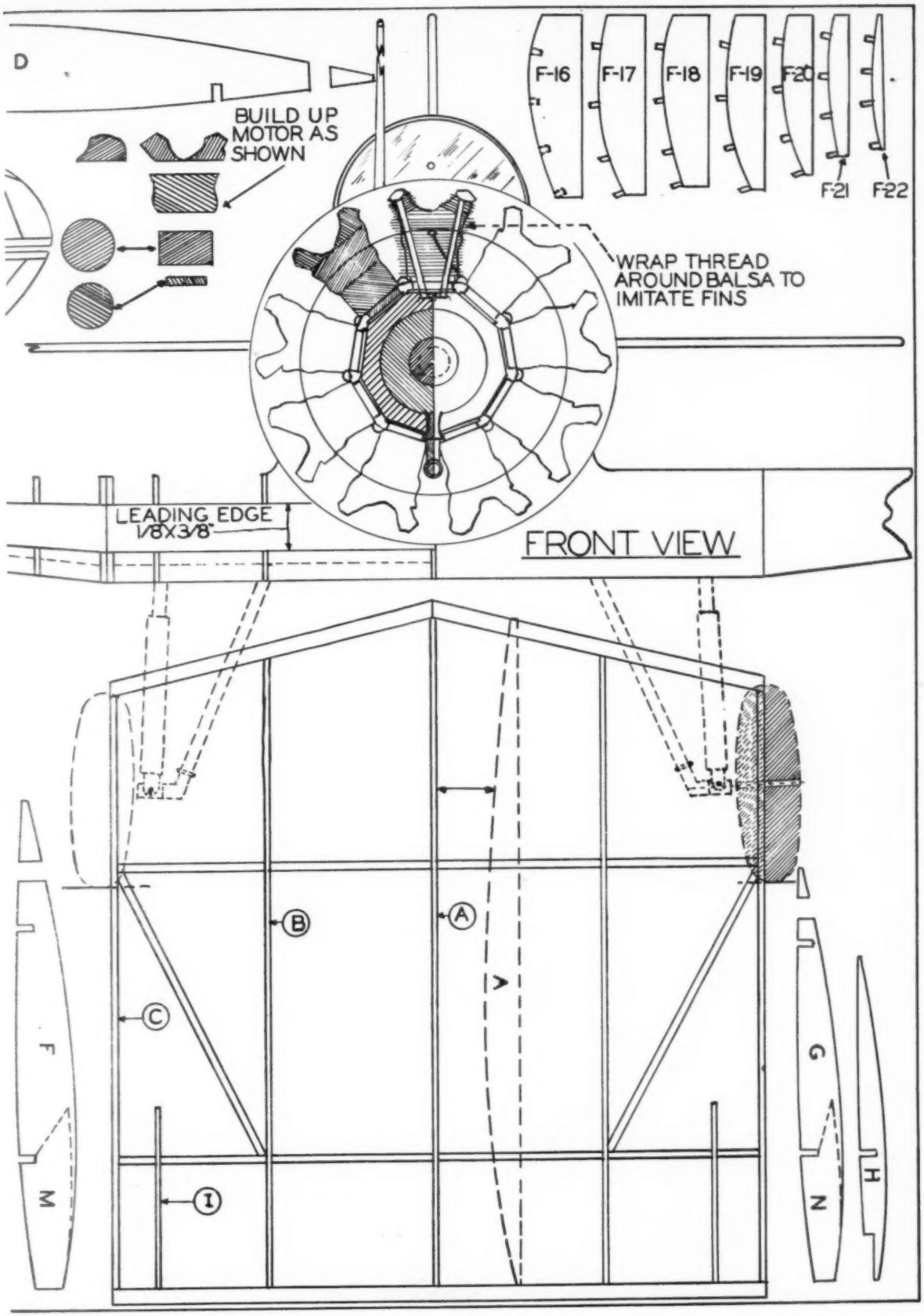
D
BUILD UP MOTOR AS SHOWN
F-16
F-17
F-18
F-19
F-20
F-21
F-22
WRAP THREAD AROUND BALSA TO IMITATE FINS
LEADING EDGE 1/8X3/8"
FRONT VIEW
A
B
C
F
G
H
I
M
N

Engines

(*Continued from page 36*)

Operation 7—Remove rear housing.

Operation 8—Blower section may be handled on engine stand or removed from stand.

We now have the engine dismantled and in a number of sub-sections. These sections may be passed through the cleaning baths, then through inspection to sub-assembly sections, then to final assembly. This is about standard practice.

Now, we might take any component in a section and break down the handling of that component into a definite number of operations. For example, let us take a cylinder that has been stripped; i.e., valves, etc., removed. The cylinder now becomes a component and not an assembly, the operations for service being outlined as follows:

Operation 1—Inspection, broken down as follows:

(a) Visual inspection for cracks and condition of bore.

(b) Micrometer measurements for taper and out of round.

(c) Guides for wear: if inspection tests show OK the cylinder may be completely serviced.

Operation 2—Cut or reface valve seat.

Operation 3—Adjust, grind and test valves. (Note valves have previously been inspected and serviced.)

Operation 4—Assemble valves and rocker arms. (Note arms have previously been serviced.)

Operation 5—Protective coating applied to liner, etc., and paint.

The cylinder now becomes a sub-assembly and may be passed to final assembly section.

Here, in greater detail, is the procedure, which may be adopted in any shop:

Inspect each cylinder internally for scores and scratches. Roughness due to scoring should be removed with a half-round Arkansas stone of fine grain. A deep scratch should not be completely stoned out as this is liable to distort the cylinder bore too much.

If all rough edges are stoned out the score will do little harm, provided of course it is not too large. If the cylinder is scored to the extent that it will cause a serious loss of compression and greatly increase the oil consumption, it should be replaced.

Occasionally a cylinder may appear to be scored, but on close examination it will be found that the piston has seized slightly, causing a slight amount of metal to adhere to the cylinder wall in the form of streaks. This metal should be removed with a hand scraper, care being taken not to damage the cylinder wall. After scraping away the metal, the cylinder should be polished with Crocus cloth saturated with oil. *Do not use emery cloth.*

After this operation, thoroughly wash the cylinder with gasoline, making sure that all foreign matter has been removed. Inspect for roundness and taper, using a micrometer or dial indicator. A cylinder which is more than .003" out of round should be replaced.

In cases where a cylinder is scratched by grit, but none of the scratches are deep, it is good practice to lap with an old piston and new rings, using plenty of oil and a very fine abrasive, preferably Crocus. The condition of the cylinder wall should be carefully watched and only as much lapping done as is necessary. All compound must be washed out of cylinders before any other operation is commenced.

If the cylinder is of the water cooled type, the water jacket should be either air or water tested for leaks, using a pressure of not more than 10 lbs.

Leaks may be easily repaired by the use of a small oxy-acetylene torch. Remove all carbon from inside of cylinder and any that may be deposited on valve inserts. Check valve guides for clearance using plug gauge, which should be of the "go" and "not go" type. If guides are worn over the limit, remove and replace with new.

Owing to the adhesion of cylinder metal to valve guides, and the heavy scoring caused by removing old guides when puller is used, it is advisable when removing valve guides from cylinders to use a pilot drill and drill through the guides. If guides are hard steel they must be pressed or drawn out of the cylinder.

The diameter of the drill should be such as to leave a thin shell when passed through the guide. This shell may be removed without damaging the valve guide hole. When guides are drawn out by use of a puller they invariably drag an amount of metal with them, especially if the cylinder head is aluminum alloy. Should the amount of metal pulled by removal of guide be such as to produce a rough hole, the hole should be reamed to take an oversize guide. When replacing guides, the average allowance for shrink-fit is .002".

First, check guide for size. Heat cylinder head uniformly until temperature around guide hole is almost sufficient to melt solder. Insert guide quickly and if necessary tap with hammer until guide shoulder is down to position. The guide may be slightly smeared with castor oil before fitting in cylinder. Allow cylinder head to cool slowly and evenly.

In refacing valve seats, make sure that the cutter face is the same angle as valve face and remove as little metal as possible from seat face. After refacing seat, test same for roundness by rubbing the valve against it; apply a little Prussian Blue to valve face before rubbing. However, should the valve fall lower than the seat, the surplus metal should be removed from the insert, using a reducing cutter.

When grinding in the valve, only do as much grinding as is necessary to obtain a gas tight seat. Use a fine grinding compound and only apply slight pressure. Don't bang valve on seat when grinding. The use of coarse compounds and heavy pressure will cause ringing. After grinding remove all traces of grinding compound.

Place valves in their respective pockets without attaching the springs. Invert cylinder and pour sufficient gasoline in the cylinder to completely cover the valves. Allow to stand for several minutes and unless seepage be noticeable in valve pockets, the valves may be passed as O.K.

To prevent injury to cylinders that have been serviced and are awaiting assembly, convenient racks should be used for storing purposes. These racks may house the cylinders both previous to and after servicing.

When servicing valves, all carbon must be removed from the head and stem, the stem measured for wear, stretch and the head examined for pits. Check for warped stems and burned heads. If the valve is in good condition it should not be refaced. If, however, the face is pitted or hammered, it must be refaced on a valve refacing machine, only removing as much metal as will allow a true face.

(*Continued in June Issue*)

B. G. MICA AVIATION SPARK PLUGS
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Corrosion

(*Continued from page 24*)

phere and forms an elastic film on the metal as the oil thickens.

Paints also serve to protect the metals from dampness, sea water, oxidation, and the various other climatic and atmospheric conditions that affect the various metals used in aircraft construction.

Surface cracks, and peeling of the paint on the surface of the metal should be periodically inspected, and if it shows signs of cracking and peeling it should be corrected immediately.

Greases prevent this action by the fact that the majority of the greases form a nonporous and uniform coating when applied to the metal. This coating is stable chemically and resists normal temperature fluctuations. Being air-proof and moisture-proof this film does not dry out or crack, and by this action tends to reduce the danger of immediate corrosion.

One of the most common practices of metallic film users to prevent this chemical action on the metals is to electroplate the metal in danger. It is very seldom that corrosion occurs. Also such ways of preventing corrosion by a metallic film are galvanizing, tinning and plating with chromium, nickel, cadmium and copper.

These methods are found to be unusually successful in the prevention of corroding metals. This coating or plating must adhere firmly to the surface of the metal to take the desired effect, and must be kept clean from all foreign substances, such as grease, soap, alkalis, and so forth.

The science of metallurgy has not yet produced a metal or alloy equally adaptable to all purposes in airplane construction. The development of the various metals and alloys used in this construction has been perfected until it has attained an unusual amount of resistance in view of the fact that it has to undergo the various types of wear, tension, corrosion and other influences that tend to tear down the metal in use.

At the present time scientists from all over the world are working in the endeavor to obtain the perfect metal, that would not only be free from the stresses, tension, and wear, but would also be free from the various types or corroding influences that are constantly working against any metal that is in contact with the open air.

No doubt in the future some such metal will be discovered and when this metal is discovered, it will revolutionize the whole metal industry. At that time the aircraft that will be produced will be constructed entirely of metal, that will not only have the durability and the lasting powers, but will also be of a much lighter and stronger material, capable of resisting the greater strains and stresses that will be imposed upon it.

END

Flood

(*Continued from page 24*)

held a pen in which three pigs were penned. Still another held his cow and calf. Each raft was tied to the other by boards nailed between them so that all made one line. Each pen in turn was tied to a tree so that should they break apart they would be tied still. A small boat made fast to the tent raft secured the old negro, he felt, against any eventuality.

When told that he was well fixed, but would have to go with them, he protested that he had gone through many floods before, in the way he was prepared for this one, including the 1927 flood. Then, too, he would have to almost give his cow away, his chickens and pigs would have to go the same way, he protested. The old man was pacified only when told that he might keep his chickens, pigs and cow and that they would be taken out of the water, too. Later he seemed to be well satisfied when established in the refugee camp.

The task of moving 13,850 people and 13,000 head of live stock is no small undertaking within itself. When we check and find that it was accomplished with the loss of no human life and only three head of mules, it begins to look like a record for future flood rescuers.

END.

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Leonard R. Peterson, Inc.
Boeing Field, Seattle, Wash.

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This advertisement appeared in March 15 issue—Time Magazine

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Boeing has always built tomorrow's airplanes today!

XUM

Smiling Eagle

(*Continued from page 22*)

the Smiling Eagle took his jumping as seriously as Dutch took his public.

Angrily divesting himself of chute harness and leaving the spread out silk panels as they lay on the ground the Eagle—still unsmiling—headed belligerently for the ship. Dutch saw him coming, climbed out and gave a perfunctory hitch at his pants. To the delight of the whooping rustics Dutch and his late passenger lambasted each other around for a couple of minutes before I could stop laughing long enough to get them separated.

But that was not the last of the Smiling Eagle, poor devil. One day, two years later, he bailed out and pulled the ring too soon; fouled his chute in the tail skid of the plane he had jumped from. The pilot, panicky at the thought of a hundred and sixty pounds swinging below the tail and making the ship almost unmanageable, dived hurriedly at the field and landed. By the time the wheels stopped rolling the Eagle's back was broken and his skull fractured. He died that night.

Dutch cracked up the Jenny. Coming in for a fast down wind landing he lost a hub cap, then a wheel, and the left end of the axle dug itself into the ground. When he crawled out the Jenny's tail was in the air, her nose and a splintered prop in the dirt, the landing gear smashed to matchwood and one wing spar broken. He sold the remains for $200 and bought an OX5 Standard. About the same as a Jenny except there was room for two passengers in the front cockpit instead of one. It was in the Standard that he took up the two drunk Chinks.

For several days we'd been having motor trouble. The thing never would cut out completely. It would run along sweetly for a few minutes, and then as soon as we'd rev her up she'd drop about seven hundred of the fourteen hundred revolutions per minute. We'd take off the magneto, tear it apart and put it back on again. No good.

Then we'd take off the carbureter, tear it apart, put it back on again. Still no good. Then we'd start taking off the mag again. This went on for days. We found out later that dirt had collected around the mouth of the gas line up in the wing tank, letting just enough fuel through to keep the motor turning over.

The thing would run pretty well after sitting idle for awhile, and it was the bad luck of the two gentlemen from the Orient to come on to the field at this time. They staggered out of an ancient Model T Ford, which judging from the smelly vegetable rack on the back was also used as a business vehicle, and made known their wishes. I eyed Dutch. Dutch eyed me back. I went for helmet and goggles. Ten bucks was ten bucks. We got the helmets and goggles on, boosted their wearers into the front pit and I swung the prop. Dutch gunned the warm motor.

With the old OX5 clacking merrily away on all eight of her worn cylinders, he lammed off down the length of the pasture and finally booted her into the air. I breathed a sigh of relief and—PHFU-UUU-TTTT! PHFU-UUU-TTT! went the motor. It didn't cut out. Just coughed from not enough gas.

There was a high line of telephone wires at the end of the field and just beyond was a broad stretch of freshly plowed field. Dutch didn't have room to set down again; he didn't have sufficient power enough to risk a turn; nor was there room to go under the wires. He wasn't low enough. So—he yanked the stick back into his stomach, mushed over the wires by inches and landed in the plowed field. The ship really didn't land. It just *squatted*.

I legged it for the scene of action, arriving just in time to hear much beautiful American profanity and a double amount of Cantonese equivalent to the same thing. The two vegetable magnates had managed to get out, one of them planting a broad Number Eight through the wing fabric.

"Ai'p'ane no good!" squalled Ah Poo Poo, running excitedly around in a circle and waving his arms.

"She go up—she go 'POOT POOT POOT'—she go down—she no go no more!"

"We wan' our money back!"

"You will give it to us, yes p'ease?"

"I will give it to you, hell no," roared Dutch, glaring disgustedly at his two passengers, the big hole in the wing fabric, and the ship itself. "Now run along and don't bother while we figger out how the hell we can get this kite out of here without taking the wings off."

There was a long pow-wow in sing-song Cantonese, more waving of arms, and finally they went, staggering off across the field arm in arm. And that was that.

THERE were others besides Dutch and I could go on and on.

The very-much-in-love barnstormer who got soused and tried to land in the hundred foot square back yard of his beloved—and did, minus the plane's wings and tearing down most of her old man's board fence. The Mexican pilot and "Beefsteak," his cub bear which got loose and tore up so many gardens that he finally tried to give it to the local zoo.

However since the town already had two girl bears in a cage, and Beefsteak happened to be a boy bear, the city fathers with much beaming and bowing politely but firmly refused. There was the day Dutch himself came flying back to the field grinning, with the fabric on his tail group in ribbons. An irate duck hunter had shot it away with a pump gun when his prey had been frightened into squawking flight by a screaming power diver. And how he managed to slide in to safety with no appreciable steering capacity is known only to the Great Power.

Dutch is buried in a small churchyard in a little town down near the Mexican border. A nose high side-slip did it. He came in after a thrilling exhibition of stunting and as a last gesture kicked the ship up on one wing, lost too much speed. For a split second it seemed to pause, then it dropped like a rock. There was a rending crash, a terrific explosion as the burst gas tanks sprayed hot exhaust stacks, a livid sheet of flame. That was all.

Late that night I walked out to the field alone. The thrill hunting crowd, tired of goggling and asking fool questions, had finally gone, its hunger satiated. It was deathly quiet out there in the middle of the pasture, and all that remained now was a blackened motor cooling in a pile of ashes and two burned wheels, their charred wire spokes twisted into queer symbols, lying among a mass of burned wire cables. I sat down beside the wreckage and in the darkness bawled like a kid.

END

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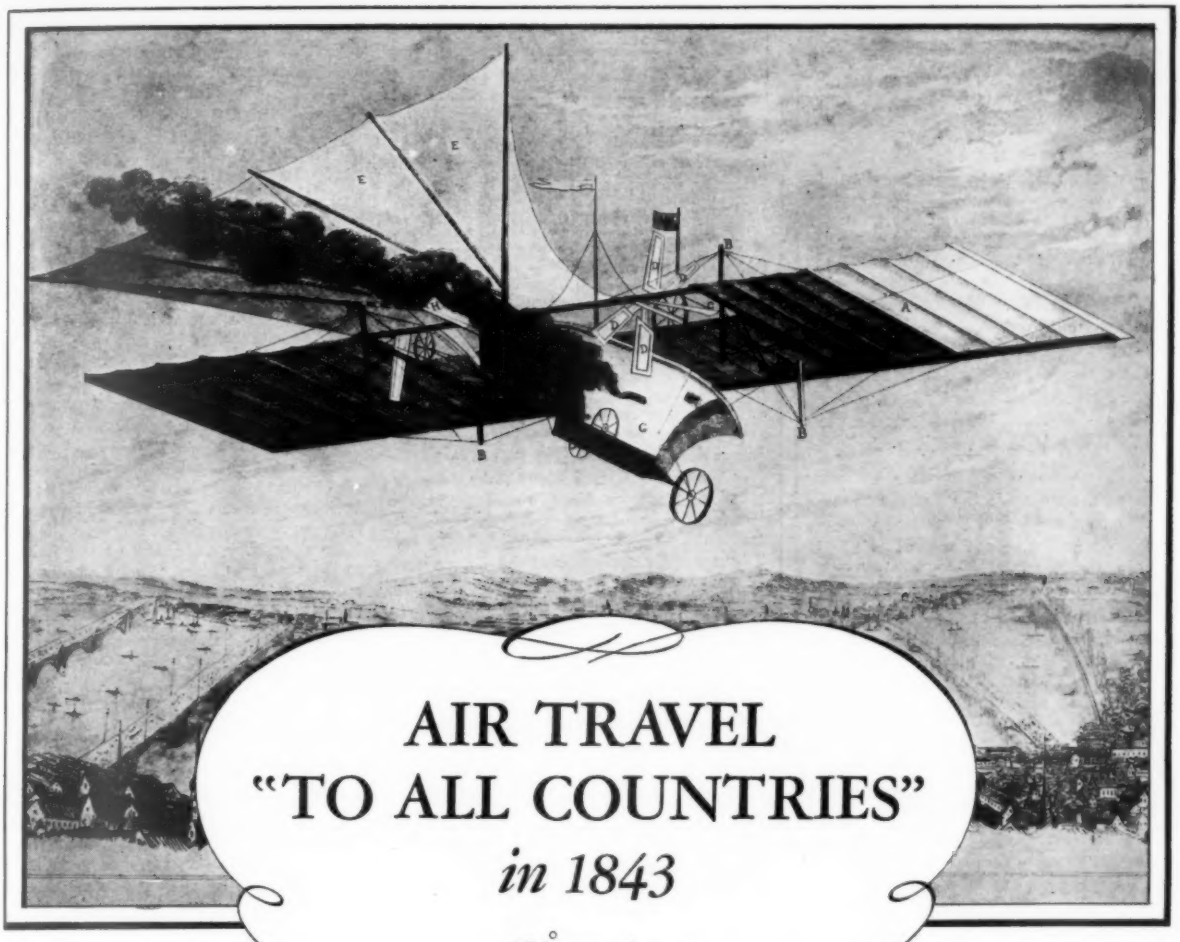

AIR TRAVEL "TO ALL COUNTRIES" *in 1843*

NEARLY a century ago, an optimistic English engineer named William Samuel Henson attempted to organize the "Aerial Transit Company" for regular air travel "to all countries." The vehicle to be used by this "gigantic enterprise" was the Henson Aerial Steam Carriage pictured above—the first airplane design to propose the monoplane.

Henson planned to use a 25 to 30 horsepower steam engine to furnish the power, actually completed a lightweight 10 horsepower steam engine to fly a model one-seventh the size of his proposed big air liner. Not one of Henson's models ever got off the ground, largely because of a woeful deficiency in his power-weight ratio.

Only with gasoline and the gasoline engine did heavier-than-air craft become a practical reality. Constant progress in engine horsepower and power-weight ratio has demanded constant progress in fuel characteristics. Today, Ethyl Aviation Gasoline is keeping pace with present demands, and Ethyl engineers are cooperating in further progress. Ethyl Gasoline Corporation, Chrysler Building, New York, N. Y.

XUM

Do You Know . . .

. . THAT Wright Cyclone and Wright Whirlwind powered airplanes of the United States Coast Guard rendered aid to and prevented the death of many residents of the Ohio and Mississippi River Valleys during the recent disastrous floods.

. . THAT, at the direction of President Roosevelt and Secretary of the Treasury Morganthau, U. S. Coast Guard airplanes, boats and men were dispatched from various points along the Atlantic and Gulf Coasts and the Great Lakes to focal points in the Ohio and Mississippi River Valleys.

. . THAT 400 motor boats, 24 vessels ranging from the 75 foot to the 165 foot class and 2,000 men were placed under the command of Captain Le Roy Reinberg, with headquarters at Evansville, Indiana, and later, as the crest of the flood moved onward, to Memphis, Tennessee, to work in conjunction with the American Red Cross and various state and municipal health authorities.

. . THAT the Coast Guard also dispatched seven Wright Cyclone powered Grumman Amphibians, three Douglas RD-4 twin-engined Amphibians, a Wright Cyclone powered Northrop Delta and a twin-engined Wright Whirlwind powered Lockheed Electra Transport to the scene of action.

. . THAT Wright powered Amphibians, able to operate from land and water, were used in reconnaissance work in transporting much needed serums and doctors throughout the stricken areas and generally affording aid to the population of the various communities stricken by disaster.

. . THAT Wright powered Northrop and Lockheed transports brought large quantities of anti-toxin and biological and other supplies from the Eastern Seaboard into the flood regions—to cure the ill and prevent the spread of disease.

. . THAT Wright aircraft engines, of the type used on this mission of mercy, also power swift, luxurious transports on American Airlines, Eastern Air Lines, Transcontinental & Western Air, Chicago and Southern Airlines, Delta Airlines, Pan American Airways System—and many other leading airlines throughout the world.

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the World Over"

WRIGHT
AERONAUTICAL CORPORATION
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Overweather

(*Continued from page 30*)

up from the Southwest conflicts with the cold weather moving down from the Canadian Northwest, and the popular title "Graveyard of the Alleghenies" is a well-earned name. The flat ridges of clouds running horizontally, called stratus clouds, which are regarded by meteorologists as representing stable weather conditions, are usually associated with warm fronts. When they occur at low altitudes they take the form of fog and rarely occur at an altitude more than three miles high.

The soft, cottony looking masses of cumulus clouds often called thunderheads, which denote unstable weather conditions and are ordinarily apparent along cold fronts may reach up to 2,000 or even 25,000 feet or more. Cirrus clouds, the "mare's tails" that stream along the sky in thin strands, are commonly met with a considerable distance above average flying levels. The upper air navigator of the future may be able to laugh at all these menaces and skim blithely above such difficulties.

The inconvenience and dangers attendant upon air bumpiness under certain conditions, are, of course, escapable when flying at sub-stratosphere altitudes. These bumps result in turbulence and turbulence, in turn results from the variance of wind velocity and direction, from terrain features which deflect the wind and from vertical air currents. If the free atmosphere is sufficiently moist and unstable, violently ascending and descending currents can arise. These are accompanied by cumulus clouds and their velocity is in proportion to the size of the clouds.

In some instances these rising currents are in excess of 100 miles per hour. Any plane moving out of a downward into an upward current would be certainly torn apart. Therefore, altitude flying would top these conditions since the rapidly thinning air above 10,000 feet soon removes much of the force from such updrifts.

The effect of rough terrain oftentimes causes grave consequences, particularly above the angular and precipitous steeps of mountains which breed upward and downward air currents (the latter are of especial concern to pilots) as well as the so-called "waterfalls," irregular eddies that swirl with such turbulence as to be wholly destructive to any aircraft involved. No airplane can hold its own against these forceful, downward-moving air currents. Too, the large bulks of buildings—"artificial terrain"—can likewise provoke tremendous eddies.

Flying amid thunderstorms has its peculiar dangers, especially when hail-storms accompany them, and a bad thunderstorm often extends upward of 20,000 feet or more so that none but overweather craft could surmount it. The warm front is ordinarily more free from danger than most of the disturbances which embarrass the pilot. Extending, as a rule, from the northwest to the southeast or east, it travels north or northwest, but a cold front with its turbulence of high winds, showers and thick clouds, makes even instrument flying very precarious.

The highest altitude achieved by man to date is 72,395 feet, or 13.7 miles above sea level. This record was set on November 11, 1935, by the two Army Air Corps pilots in the "Explorer II," of the National Geographic Society. The gondola of this, the largest manned balloon ever built, was composed of magnesium alloy and the bag supporting it, together with over a ton of scientific machinery, had a gas capacity of 3,700,000 cubic feet. This was probably almost twice as high as the average commercial transport plane will attempt to climb for several years to come.

Not quite a year previous to this balloon expedition, Wiley Post had accomplished great steps by way of sub-stratosphere fly-

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ing, when in his small but efficient Lockhead Vega, the "Winnie Mae," which had carried him twice around the world, he flew in the sub-stratosphere from Los Angeles to Cleveland at 340 miles per hour. This more than doubled the normal speed of the little craft which had been fortified with an Eclipse supercharger and a Smith controllable pitch-propeller to take advantage of reduced air densities at extreme altitudes.

This was not the first of Post's excursions into the sub-stratosphere. He had carried on several such under the auspices of TWA, always flying his own rather aging Winnie Mae despite the arguments that such experiments merited ultra-modern equipment and extensive preparations. Post had attached one supercharger to his Wasp engine before making his world flight in 1933, and, in preparation for his altitude records, he installed another one.

This procedure was calculated to shove up the 4.37 pounds of atmospheric pressure to about fifteen pounds intake manifold pressure at the 30,000 foot altitude intended, and so obtain for him power efficiency about equal to that comfortably near the earth. "As a result of this flight," Post declared, "I am confident that airplanes can travel at terrific speeds above 30,000 feet by getting into the prevailing wind channel." It will be remembered that Post's original oxygen-feeding apparatus was comparatively crude although ingenious in design.

A rubber flying suit, with helmet attached by air-tight jointings, encased his entire body in uniform sea-level pressure. Two valves in his helmet allowed him, at any height, to blend and maintain his air supply at a density identical to that available on the surface of the earth.

One of these valves admitted air under pressure from the supercharger of the first engine, the other allowed for the entrance of oxygen. The expelled air escaped through exhaust valves in his boots.

TWA is carrying on where Post left off, but overweather flying is not even as easy as it sounds and there is yet a long, hard battle to be fought before the super-victory over the sub-stratosphere can be won. But eventually it will be won and that victory will be more than worth the battle.

END

Canada

(*Continued from page* 40)

ness expands and justifies larger planes it is likely that the 23 passenger Douglas type ships will be placed on the transcontinental route while the Lockheeds would then be operated on feeder lines. Both these types of machines are the same as are in use on the principal American air-lines.

Canada has sufficient pilots trained for blind-flying and thus qualified for the service to begin the Transcontinental. Canadian Airways Limited alone has 12 such aviators while others have similar training. The average pilot in Canada, however, is not so experienced as it is unnecessary in the north country where radio-beams and blind-flying have been impossible to inaugurate. All flying has been subject to weather conditions and must be done during daylight hours. A pilot loses his license if he flies more than an hour after the sun goes down.

As to ground men Canada may find a serious shortage of trained personnel as it requires 10 persons in addition to the plane crew to keep one machine in the air. This will be one of the problems to be solved by the new corporation.

Establishment of the necessary facilities is costing the Dominion government about $8,000,000. This figure includes the preparation of 120 emergency landing fields, construction of hangars, and installation of radio and beam facilities. Approximately $7,000,000 has already been spent while, by the time the remaining $1,000,000 is expended, the government anticipates that final work on landing fields and hangars as well as installation of radio and beam facilities, will be complete from coast-to-coast. It is estimated that $1,500,000 will be required to set up the operating company with equipment and personnel.

Stimulation of passenger traffic for the planes will be the principal task once the service is established and it is believed that, as soon as Canadians are shown how rapid, comfortable and safe air travel is, there will be little difficulty in getting a lucrative business so that the corporation can pay its way. If necessary the government is prepared to subsidize the service until it is on a profitable basis.

END

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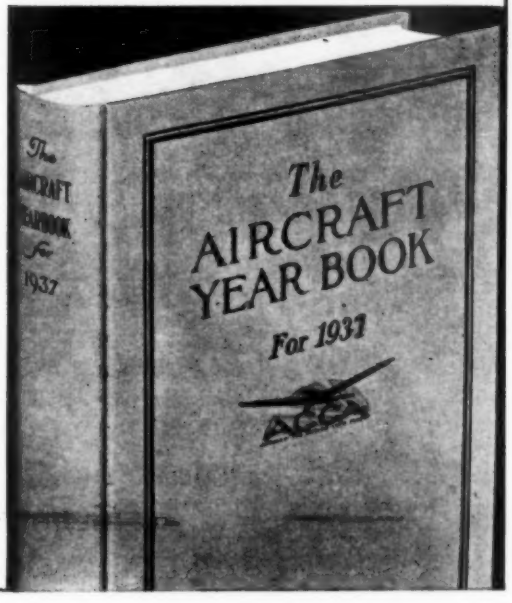

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XUM

Horses

(*Continued from page 33*)

rear cockpit, replete in flying clothes, was my friend the General, wishing no doubt that he was right down on solid terra firma and not even in the cockpit. While Colonel Short, in riding boots and spurs but with a regulation flying coat, helmet and goggles, stands holding the left wing like he'd hold a bridle.

But let me quote the cut-line this picture carried, viz.: "Brig. Gen. Robert L. Howze wanted to see how the horses and men of the Seventh Cavalry behaved on formation. So, also, did Colonel Short, new commanding officer of the Seventh, who recently returned from Coblenz. Lieut. de Shield of the Border Air Patrol took the General and the Colonel for a spin in the sky, from which vantage point the commanding officers inspected the cavalry."

"'Of course I enjoyed the ride,' said General Howze. Floyd Logan, cameraman for International Newsreel, and the man who took this picture, registered no enjoyment. While he and Major L. J. Hefferman were flying ten feet over the galloping horses to get a realistic picture of the charge, one of the tripod legs of Logan's camera wedged into the elevator control of the airplane. It looked for an instant as though Logan and the Major were about to take an unwilling part in the charge of wildly plunging horses beneath them. But the Major gained control of the ship and scaled to loftier and safer altitudes."

Then, about one week later, the general handed me this:

WESTERN UNION

P F 85 WASHINGTON D C JULY 19 1040 A
ROBERT L HOWZE BRIG GEN U S ARMY
COMMANDING EIGHTH CORPS AREA
FORT BLISS TEXAS
CONGRATULATIONS TO YOU AND COLONEL SHORT FOR MOST REMARKABLE CAVALRY CHARGE PICTURES IN CURRENT RELEASE NINETY SEVEN INTERNATIONAL NEWSREEL CONGRATULATIONS YOU ARE STILL LIVING AFTER WILD DIVE IN AIRPLANE
U S WAR COLLEGE

To which the General replied:

WESTERN UNION

RB 34 15 FORT BLISS TEXAS JULY 19 335 P
U S WAR COLLEGE
WASHINGTON D C
THANKS BUT I DO NOT FLY AND I STILL THINK ALL NEWSREEL MEN ARE LIARS
ROBERT L HOWZE BRIG GEN
COMMANDING EIGHTH CORPS AREA
END

Air Board

(*Continued from page 32*)

loading ships for very long plights. But the idea of using catapults and dispensing wholly with the landing gear opens up an entirely new line of thought.

Moreover, here are some rumors: Somewhere in the middle west ships are making successful belly landings more advanced even than those made by Beechcraft because the fuselages of these ships are actually equipped with shock absorbing elements in the underside of the fuselage. Somewhere in the middle west a movable track is being shifted around on fields by tractors and this track designed something on the escalator principle shoots planes off like a catapult and retards them when they land on the belly of the fuselage.

These are rumors for which the Air Board cannot vouch, but if our readers will use their imaginations they will see that a vast new field may be opened up in aviation by such a system. The suggestion of the Air Board was that before the Department of Commerce undertakes intensive experimentation in catapults, it should perhaps first study thoroughly all that has been done and is being done today.

ROTARY WING AIRCRAFT—A SUB-COMMITTEE OF THE N. A. C. A.

Following on the suggestion of E. B. Wilford, the Chairman of the Board was instructed to write to the National Advisory Committee for Aeronautics suggesting the appointment of a sub-committee on rotary aircraft. Only two companies in the United States have worked actively in this field. At engineering societies' meetings rotary aircraft is rarely if ever discussed. With the sad death of LaCierva (in an airplane accident) there is some danger that rotary aircraft may suffer from some apathy in American aviation and be unduly neglected.

As Captain Depew states, there is one tremendous advantage that the autogiro seems to hold over flaps and other devices, notwithstanding. In an autogiro it is possible to fly over congested Long Island and to come down to 500 feet to watch a golf game, let us say. Whatever the character of the terrain may be, it is possible to land almost anywhere with a minimum of risk. Captain Depew, an experienced flier, said that this gave him an indescribable sensation of safety!

Whatever may be the doubts as to the speed possibilities of rotary aircraft, it is equally certain that the giro has a sphere of activity of its own and the possibilities of rotary aircraft should never be lost sight of.

HOPES FOR GREATER SAFETY

A member of the Board asked what was the likely outcome of the recent Safety Conference between the Air Commerce Bureau and the airline operators.

The final recommendations of the Conference were divided into two parts. The first group for immediate action was as follows:

(1) Adoption of auxiliary means of navigation by all air liners. This calls for utilizing the radio compass or radio direction finder. It is supplementary to the radio beam. (2) Installation of directional and homing devices on all air liners. (3) More exacting navigational training of air line pilots. (4) Near-future installation of an air log on all air liners, to record movements of the aircraft, such as altitude. (5) Installation of anti-static shielded loop antennas on all aircraft. (6) Promulgation of Approved Type Certificate airliner radio equipment regulations. (7) Installation on only simultaneous ranges on Federal airways. (8) More detailed and accurate radio maps issued by the Government. (9) Pilot training on Link trainer by all air lines. (10) Expedition of airport approach light installation by the Bureau of Air Commerce. (11) Creation of an expanded Safety Research and Development Section of the Bureau of Air Commerce. This section would include a committee representing the air lines and other interests involved which would advise the Department as to the subjects most urgently in need of investigation, experimentation and development.

The second group of cooperative study included (1) Improved and more adequate airway aids and weather reporting systems. (2) Modernizing ground and plane radio equipment. (3) Federal ground direction finding for emergency use.

These technical measures are of the greatest possible value for American aviation and there is not the slightest doubt that great technical progress will follow. Another and equally important derivative of the Conference is a better feeling between the Air Commerce Bureau and the operators. Subsequent to the accidents and prior to the Conference there were charges and countercharges, bitter blasts in the press. The beginning of the conference was, we understand, far from being a friendly gathering, but little by little all ill will disappeared.

At a recent meeting of the Advertising Club in honor of Howard Hughes, the transcontinental speed ace, E. R. Breech, Chairman of the Board of North American, stated that airplane designers were concentrating their efforts on comfort, safety and quiet rather than speed in the designs for 1938.

Mr. Breech said, "you will see comfort not speed representing the greatest achievement." Colonel E. V. Rickenbacker at the same gathering went even further and stated that before long airlines will give passengers in comfort and safety what Hughes has given them in speed.

END

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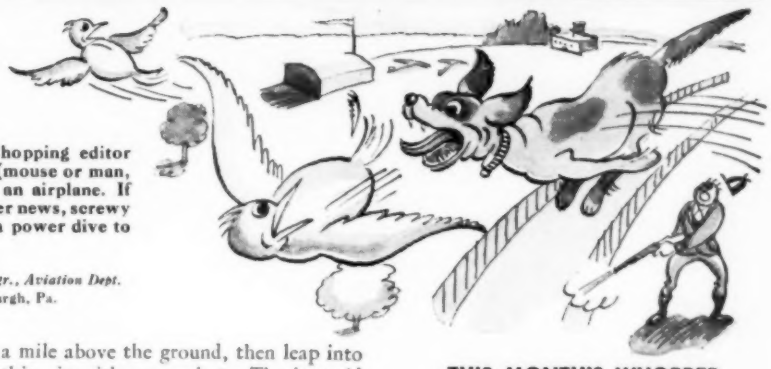

Among other cock-eyed items, your hedge-hopping editor would like to know whether any living thing (mouse or man, we don't care which) has ever been born in an airplane. If you have the straight dope on this—or any other news, screwy happenings or printable gossip—please take a power dive to the nearest swivel chair, and send a line to:

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips," *Mgr., Aviation Dept.*
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

W. T. CALLED BAG OF WIND

"Either the editors in Bridgeport have been asleep since 1900 or W. T. is a bag of wind.

"I refer, of course, to the latter's spiel in the last 'Perch' about a night watchman flying a plane down the streets of Bridgeport several years before the Kitty Hawk flight.

"I've read Bridgeport papers for 40 years and W. T.'s story is sure news to me. I think it's a lot of hooey—and that W. T. ought to be fried in a big pan of his own banana oil." —A. S.

BIRTH NOTICE

Born at Gulf's Port Arthur refinery recently, a phenomenal new oil for planes—*Gulf Airline Oil*. It is a 100% Pure Pennsylvania oil, blood brother of *Gulfpride*, the world's finest oil for cars.

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FIRST AIR ROMANCE

"The lady's maiden name is not recorded. But she was a Russian. And young. And beautiful. And the world's first woman parachute jumper.

"The man was Garnerin, a French balloonist—one of the most famous daredevils of the eighteenth century.

"Garnerin's greatest rival was an Englishman, Blanchard. For a time the two were equally popular with the public. Then Mrs. Blanchard decided to join her husband in the risky business of ballooning . . . and the flying team soon made Garnerin take a back seat.

"But the Frenchman heard about the Russian girl. She was said to ascend half a mile above the ground, then leap into thin air with a parachute. The intrepid young lady actually made what is known today as a delayed jump, hurtling through space for hundreds of feet before she opened her parachute.

"Garnerin went to St. Petersburg. He saw her make one parachute leap and immediately signed her up as a teammate. Shortly thereafter, they were married.

"Returning to France, the Garnerins soon became as celebrated a team as the Blanchards. The rivalry between the families was tremendous. Each tried to outdare-devil the other.

"The rivalry almost cost Madame Garnerin her life. One day her balloon burst into flames and smacked her against a Paris housetop. Although injured, she did not lose her nerve, but started flying again as soon as she recovered.

"This correspondent cannot find what finally happened to the Garnerins, and would appreciate any further information." —C. F., Brooklyn, N. Y.

WISH WE HAD A DOLLAR A HEAD

A few weeks ago American Airlines carried its 1,000,000th passenger—the world's first airline to reach this memorable figure. The editors extend their congratulations and sincere good wishes for the future.

THIS MONTH'S WHOPPER

"There is nothing, gents, that I'd rather wrap my lips around than quail on toast.

"But I'm the worst shot in Newton County—and sometimes miss so many birds that even my dog won't speak to me.

"One day while hunting at the airport, my dog set three coveys, and after I had blazed away without bringing down anything but the corners of my lips, the dog got so mad that he just marched away and lay down beside a drum of Gulf Aviation Gas.

"The bung was loose and some of the gas had dribbled out. I saw the dog sniff, then bark like he'd found a bone, and begin lapping up the gas.

"I managed to get him away and on with the hunt. Soon he set again. On the rise I started to shoot, but what I saw froze me stiff. There was my dog speeding

through the air like a gol-darned hawk, gathering the quail on the fly. He got the whole covey before they'd gone a hundred yards.

"Now I don't take a gun with me any more, just an eye-dropper of your gas and the dog." —Dave Hovey, Union, Miss.

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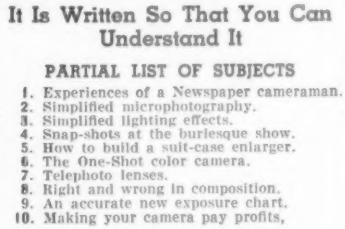

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Heroes

(*Continued from page* 16)

of them spoke up and said, "There's a new ship out there to be tested. They say she can fly."

Back to the realities of life they came, shrugged their shoulders and went on with the affairs of the day.

To Major Albert F. Hegenberger of the Army Air Corps, the world owes much in developing safety in flight. It was partly due to his brilliant work in the field of air navigation the public gained confidence in this mode of travel, thereby, bringing about a demand for the expansion of aeronautical industry.

During his duty at McCook Field, and later at Wright Field, he made a number of long-distance flights through fog, or above the clouds, depending on the earth inductor compass to guide him. Such flights added considerably to a pilots ability to use this compass.

As a result of his knowledge of air navigation and his many tests of the aeronautical instruments the Air Corps had developed, he, with Major Lester J. Maitland, was able to make the first non-stop flight from California to Hawaii on June 28-29, 1927, covering more than a 2400 mile stretch over the Pacific Ocean in a flying time of slightly more than twenty-five hours. This indeed, marked a step in the forward march of aviation. It paved the way for the Pan-American Airways across this body of water.

Not only did Major Hegenberger's competent investigations make it possible for him to make this noteworthy flight but he also, by his investigations, achieved the distinction of being the first Army pilot to make a solo instrument landing; he it was, who first flew alone in a plane with the cockpit covered. He took off from the field, flew a distance away, came back and made a successful landing. This remarkable flight was hailed the world over as one of the major contributions to aviation progress. For the man in the air had won a great victory against his worst enemy of flight, fog.

In these pages we have told you only a few of the many important airplane performance tests and instrument tests made by this essential unit of the U. S. Air Corps Flying Branch. There are still many more which could be told. Tests, which have brought forth results that have changed the whole trend of aviation development.

Tests, wrought with special hazards to the life of the individuals who have made them: for it has been the aim of these courageous pilots attached to this branch to see that the U. S. Air Corps' equipment comes up to Army specifications and that our planes are equal, if not better than those possessed by any other Air Force in the world.

It has also been their desire to see that our military airplanes are of such formidable construction and design that no other nation would dare invade our air space. To accomplish this purpose these tests are naturally, by necessity, dangerous.

Not only are there many more important tests that have been made by the Flight Test Unit that are worthy of record, but there are many more names of able and heroic Test Pilots we could recall to you who have done remarkable developmental work in the Air Corps, such as: Major St. Clair Street, the outstanding figure in the pioneering Alaskan Flying Expedition; Major Frank O. Hunter, one of the few remaining aces in the army; and Major John A. Macready, thrice holder of the Mackay Trophy—a trophy awarded annually for the most outstanding accomplishment of the year in aviation; as well as the rest of the twenty-five or more pilots who have been detailed to this experimental unit throughout its history.

However, we do wish to make special reference to the work done by Major Hez McClellan, who was killed May 26, 1936, near Centerville, Ohio, while making a test flight of one of the army's newest airplanes.

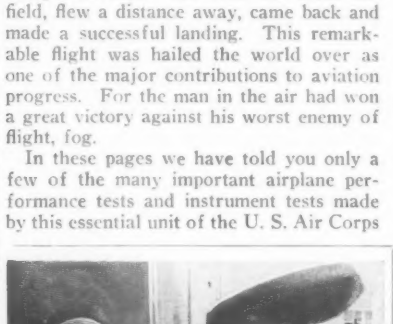
Major McClellan, when he was assigned to Wright Field, Dayton, Ohio, in November, 1935, as Chief of the Flying Branch, brought with him a vast fund of information on air navigation; for he was a pilot of long experience, having taken part in a number of Air Corps flights of great import.

He participated in the flight of ten B-10 Martin Bombers from Washington, D. C. to Fairbanks, Alaska and return, July 10 to August 20, 1934, serving as Supply Officer. This flight, which was commanded by Brigadier-General Henry H. Arnold, now Assistant Chief of the Air Corps, covered an estimated distance of about 8,290 miles.

Then again on June 12 to August 14, 1935, accompanied by Sergeant Tamosan and Corporal Krause, he piloted a Douglas C-29 amphibian on an airplane reconnaissance of the routes to and from Alaska and throughout the territory of Alaska. During this journey he flew a total of 135 hours and 25 minutes, and secured a valuable photographic record of the places he visited.

Many of these flights made by Major McCellan were of a pioneering nature. His was the first military airplane ever to land at Point Barrow, or to return from Point Barrow to Fairbanks over the route taken.

This is worthy of recognition due to the fact that the land he flew over was uninhabited and rugged, among the most desolate spots one could find if he searched the world over for such a place. Truly a dangerous route to take, for his maps



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were inadequate—not indicating a suitable place to land in case of airplane failure. Such conditions will never have to be experienced by another aviator flying in Alaska, for Major McClellan brought back with him an excellent and complete survey of the terrain he flew over.

With deep regret the Air Corps heard of the airplane crash in which Major McClellan was killed, while testing one of the Army's planes; for they knew they had not only lost an officer of sterling character, but that they had lost a pilot whose knowledge of aviation was worth much to the development of military airplanes.

As time goes on, we regret to say the Flight Test Unit of the Air Corps will continue now and then to take its toll of human life; for the testing of the new Army airplanes must go on in order that the security of the nation as a whole will be safe-guarded if we are called upon to protect our frontiers. Such has been the history of all progress. It seems there is some power over it all, one we do not understand, which has ordered: Man must pay, and sometimes dearly, for the advancement of civilization.

Note: References to flights of Major Hutchison, Captain Bruner, and Lieutenant Barksdale are based on incidents from A. M. Jacobs: "Knights of the Wing," published in 1928. END

Engines

(*Continued from page* 16)

aluminum alloy, which contains the Combustion Chamber and is screwed on to the cylinder barrel while hot. The cylinder head and barrel are fitted with very closely spaced cooling fins.

Each valve is equipped with an independent set of rocker arms, which are completely enclosed in a water tight box. These rocker arms are fitted with a special device to take up clearance.

The propeller can be either mounted "direct driven" by the engine shaft or fitted to a reduction gear of the planetary type. The front end of the propeller shaft is equipped with splines of which all classes of propeller hubs, whether of wood or metal, can be mounted.

A Centrifugal Type Super-Charger, fitted with adjustable stages, permits varying the degrees of compression of the engine at ground level or at different altitudes. The engine which should not be opened "at full throttle" at sea level is equipped with a "throttle stop," the clutch of which can be released permitting extra power at "take off."

The lubrication of the principal parts of the engine is done under pressure. The circulation of the lubricating oil is affected by geared pressure and discharge pumps. The oil is strained by a separator on entering the engine system. Each set of rocker arms is equipped with a special automatic independent system of pressure lubrication.

All the accessories are mounted on the rear half of the crank case; consisting of two magnetos, two oil pumps, a dynamo, a revolution courter drive, two machine gun gears, and receptacles to connect a mechanical starter, an air compressor, a vacuum pump, etc. END

Airy Chat

(*Continued from page* 12)

son to believe that this is one of the most popular of all our departments, our belief being based upon stacks of letters asking for its re-establishment.

* * *

GAS MODEL flying is now becoming one of aviation's leading industries and we confess, with a modest blush, that the present enthusiastic gas model flight activity was started in the columns of ol' P.A. about one year ago. Since that time, thousands of gas models have been built and successfully flown; power-plants have been improved and reduced in price to the point where nearly everyone can engage in this great sport. And our best word to you is to start building your gas model for the coming summer competitions and contests. You'll sure get a lot of kick out of it.

* * *

JOE OTT, our former Model Expert, was encountered on the street the other day with his arms full of cameras. He is running ye Editor a race for the greatest number of cameras under one ownership, and he is pushing ye Editor hard against the wall. He confesses to adding seven cameras to his collection, this past twelve months, while your poor old Editor still leads by an annual increase of nine pop-bottles. Attaboy.

* * *

ALL of our amateur lightplane builders will be interested in the fine article on control construction, written for this issue by Raoul Hoffman. This article is exceptionally well illustrated and shows about every control gadget on record. Dope on control construction is difficult to get, hence you fellows had better seize this opportunity of getting acquainted with the joy-stick.

* * *

A NEW constructional material, known as Endurite, is claiming the attention of engineers. It is, evidently, just another phenol resin product that has a tensile strength equal to mild steel; is transparent; can be molded readily in the cold condition and is an insulating body. It is not yet ready for market, but we can see possibilities for it in aviation, particularly for the reason that it is much lighter than Dural.

J. B. R.

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3/16x3/16 8, 5c
¼x¼ 6 for 5c
¼x⅜ 3 for 5c
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1x1½ 9c; 1x2 10c
1x3 15c; 2x2 18c
2x3 23c; 2x6 39c
3x3 40c; 3x6 75c
TISSUE, AA
All col., doz. 19c
Silver ....ea. 5c
Superfine, wh. 5c
WHEELS per pr.
Brch Balsa Celu
½ .01 .03
⅝ .02 .04 .05
1 .03 .05 .07
1¼ .04 .08 .10
1½ .07 .10 .16
3 .15 .30
PINE WHLS., pr.
Both sides alike
¾" 4c; 1" 6c
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NOSE BLOCKS
1x2x1..... 1c
2x2x1..... 2c
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3x3x2..... 8c
3x3x3..... 10c
INSIGNIA
24 and stripes 5c
WASHERS
1 doz. ¼ or ⅜ 1c
THRUST BEARINGS
Small ...doz. 10c
Large ...doz. 15c
RUBBER
.045 ....25 ft. 5c
1/16 sq., 20 ft. 5c
⅛ flat ...18 ft. 5c
3/16 flat..12 ft. 5c
Skein 5c
PROPELLER BLOCKS
½x ¾x 5 8—5c
½x ¾x 6 6—5c
¾x1 x 7 4—5c
¾x1 x 8 3—5c
¾x1¼x10 2—5c
¾x1¼x12 3c ea.
1 x1½x12 4c ea.
1 x1½x15 6c ea.
SHEET ALUM.
.0002x3½... ft. 1c
.005 in. 6x6 5c
.010 in. 6x6 6c
CLEAR DOPE
5c per oz.; large bottle 8c; ½ pt. 30c; 1 pt. 45c
THINNER
Same as clear dope
COLORED DOPE
6c per oz.; large bottle 8c; ½ pt. 35c; pt. 60c
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5c per oz.; large bottle 8c; ½ pt. 25c; 1 pt. 35c
MACHINE-CUT BALSA PROPS
5" 4c; 6" 5c
7" 6c; 8" 7c
10" 8c; 12" 10c
15" .15c
BAMBOO
1/16 sq. x12, 3c, 5c
1/16x¼x15, dz. 10c
DOWELS
1/16x6 ...doz. 5c
⅛x18 ...2 for 3c
3/16x½...2 for 5c
WIRE
6-8-10-12-14 .....2 ft. 1c
WOOD VENEER PAPER
20x30....1 for 10c
BAMBOO PAPER
2 for 15c
CELLULOID
6 x 8.....5c
12½x16....18c
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12" 10c; 15" 15c; 24" 20c.
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CAMEL'S HAIR BRUSHES
Small 3c; Lg. 5c
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½".....doz. 8c
DUMMY RAD. ENGINE (Celu.)
½" d. 15c; 2" d. 20c; 3" d. 25c.
ENGINE AND COWL (Celu.)
1½" dia. 15c
2" dia....20c
3" dia....25c
CELLULOID PANTS, per pair
½" to 1" 18c
1¼" to 1¾" 35c
METAL PROPS.
2 bl. 3 bl.
1½"...5c... .08
2½"...10c... .10
3½"...15c... .20
4½"...20c... .25
ALUM. TUBING
1/16,3/32, ¼ ft. 7c
3/16 or ⅜ ft. 10c
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1½" 15c 2" 18c
3" 25c
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Doz. sheets....5c
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Ordnance

(*Continued from page 28*)

pilot's will. This device superseded all others in Allied forces and remained standard for several years after the War.

German superiority was in the balance from that time on. Each side had equally good ordnance; it remained for the aircraft industries to go to work and produce super fighting craft.

When the C.C. gun gear was standardized in late 1916, it unleashed the Sopwith Camel, the Spad 7, Nieuport 24, the S.E.5, such fine two-seaters as the Breguet, D.H.4, the Bristol F2.B and subsequent types.

No. 56 squadron, R.F.C. entered the battle of Arras in early 1917 with C.C. gears on some of its S.E.5's but No. 55 (D.H.4) and No. 18 (Bristol F2.B) were allotted the first full consignment of the new gears. These machines also had twin Lewis guns for their observers.

This incident of fitting C.C. gears to two-seaters in advance of single seaters is the first instance that the value of a Two-Seater pursuit machine was weighed. Thus a new chapter in the history of military aeronautics was written.

The first Allied answer to Germany's side-by-side machine guns was the superimposed arrangement of the S.E.5. This machine had a synchronized Vickers mounted under the cowl, and a Lewis on Foster mount firing over the propeller arc, but flexible to permit vertical firing. The Camel carried twin Vickers, German style.

France stuck to the British superimposed mount with the exception of the Spad 7 single gun until August, 1917, when twin guns were adopted.

Accordingly, January, 1918, marked the birth of modern aircraft. From that time on, wonders were performed with aircraft, and the various divisions of military flying were developed from that date.

Large mass formation flights were commonplace; bombing raids en mass were frefrequent. Moreover, the excellent ordnance available had permitted daring designers to build bombing machines which were capable of defending themselves against great odds.

The two-seater fighter (Hannover, Breguet 17C-2, Bristol F2B) was perfected to such a high degree that it took two mighty good single seaters to shoot down an average two-seater. Major A. E. McKeever, became Britain's two-seater ace when he had destroyed 30 German aircraft in a year and a half. To top this one off, McKeever had only one eye!

Of course, the War was not without fantastic examples of armament. Georges Guynemer had fitted a 37 mm. cannon between the blocks of his Geared Hispano engine which fired shells through the propeller shaft. Fonck tried this arrangement, but gave it up because each shot had to be hand loaded.

Late in 1918, the Fokker Flugzeugwerke had perfected a twelve barrel affair which fired a murderous hail of lead at the rate of 7,200 rounds per minute! Fortunately for many Allied pilots, this machine gun was not put into production.

French Voisin, Farman, and Breguet machines were at various times fitted with cannon firing a 1½ lb. shell. Obviously the effect of the recoil on the plane's structure limited the cannon's use, but the Royal Naval Air Service had developed a weird contraption called the Davis non-recoil gun.

The weapon was quite unwieldy and fired a compensating charge out its rear end. Its use was limited to large flying boats patrolling for German submarines. Various night bombers spewed fire from a 1 pounder pom-pom gun probably more to scare the Germans than materially damage them.

Increased efficiency in weapons brought greater range and more potent piercing power to the slugs. As a means of protection, many aircraft in the last year of the war were heavily armored. This was particularly true of the German A.E.G. J.1 ground attack model, and the Sopwith Salamander, both of which were equipped with heavy steel plates over their vital parts.

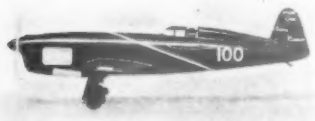
Due directly to the perfection of the synchronized machinegun was the incredible advance in aircraft performance the four short years of war. Scout speeds jumped from about 90 miles per hour to over 140. The two-seaters were regularly travelling over 120 miles per hour in 1918 where a few months before 85 miles had been accepted as first rate.

Bombing machines perhaps made the greatest speed improvement of all. The year 1916 found 50 to 60 miles per hour good speed for a bombardier, but this snail pace was lifted to over 110. Some bombers which were not put in production because of the Armistice were as fast if not faster than most single-seaters!

As cases, consider the D.H. 10A which could go 128 miles per hour at sea level. The D.H.15 did 141 at 10,000 feet. The Boulton and Paul Bourges were credited with 135 miles per hour at sea level, and in Germany, the Gotha G.IX officially recorded a speed of 121 miles per hour at 3,000 meters.

So next time you marvel at a sleek military airplane, don't give its designers all the credit, but think back to the beginnings of military aircraft and remember how the perfection of aero ordnance permitted the production of today's marvelously efficient fighting aircraft.

END



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1/16x1/8 ... 15c
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3/16x2 20 for 31c
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1/16x1/16x12 gross 15c

JAP TISSUE
Silver, doz... 19c
White, doz... 11c
¼ ream... 1.05
Colored, doz... 13c
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½x⅝x6 ..... 5c
5/8x1x7 ..... 12c
5/8x1x8 ..... 16c
⅝x1¼x10 ..... 25c
¾x1¼x12 ... 30c
1x1½x12 ... 38c
1x1½x15 ... 52c

CLEAR DOPE
1 oz. ....doz. 40c
10c seller, dz. 60c
Gross 6.75
½ pt. 25c 1 pt. 35c
1 qt. 65c ½gal. 90c
1 gal. each. $1.50

COLORED DOPE, All Colors
1 oz. bot., dz. 55c
10c seller, dz. 65c
Gross $6.90
½ pt. 27c 1 pt. 45c
1 qt. 70c
½ gal. $1.25

CLEAR CEM'NT
1 oz. bot. dz. 40c
10c seller, dz. 60c
Gross $6.75
½ pt. 28c Pt. 40c
1 qt. 60c
½ gal. $1.00
1 gal. 1.75
5 gal. 6.50

BUSHINGS
1/16 I.D., 100 15c

WASHERS PER 100
⅛ or ¼ O.D. .5c

MACHINE CUT PROPS. per doz.
5" ...20c 6" ..21c
7" ...30c 8" ..35c
10" ...35c 12" .60c

WHEELS, doz.
Birch Bal. Cel.
½" .04 .05 ...
¾" .05 .10 .24
1" .07 .13 .25
1¼" .09 .18 .35
1½" .13 .35 .60
3" .75 1.50

WIRE, 100 FT.
No. 6..... 20c
No. 8..... 23c
No. 10..... 25c
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PROP. SHAFTS
1 gross..... 45c

NOSE BLOCKS PER DOZ.
1x2x1 ..... 6c
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TRI-STATE COLLEGE

Antarctic

(*Continued from page* 18)

the camera could be stopped down to its smallest aperture and then given any amount of time necessary. Incidentally, I always allowed an increase of one stop, that is, let in more light to compensate for the effects of the extreme cold on the film. The film actually slowed up the equivalent of one stop due to the cold temperature.

Half of the power for lighting for interior photographs always came from the portable generator, and half came from the main supply. There was never enough power from either source to supply all of the power for the lights. The main power circuit would fluctuate too, especially when someone started up a drill or a band saw. Sometime's the main camp's power was augmented by a wind generator outside on top of a sixty-foot tower. At times, all of the power came from this wind generator.

The wind was not steady, of course, and this was another source of considerable fluctuation in the amount of power supplied—again, not noticeable to the eye.

A point to be remembered on interior pictures at night is that more light is needed than for pictures taken outside. Pictures outside can be taken with less power and still have the same depth due to the greater distance from camera lens to the subject. It is a matter of depth of focus. The depth of focus is the distance from the first object from the lens in sharp focus to the far object from the lens in sharp focus. The smaller the shutter opening the greater the depth of focus. The smaller a room, the smaller the stop should be in order to increase the depth of focus and have as much as possible of the room in sharp focus. The smaller the stop, the more photoflood lamps that must be hooked on the power line. Large rooms required lots of light, too, because of their size, consequently, the problem of power was an ever-present one on all interior shots. This meant the portable gasoline generator had to be used each time. It couldn't be kept in a room while running because of the gasoline fumes. It had to be kept out in the passageway, or tunnel.

The tunnels were quite cold, their four sides being snow and ice. The generator would often slow down from the extreme cold as the oil would freeze up and stiffen while the generator was running.

Before I give the impression that a photographer at Little America is never confronted with anything but troubles I should say that every man on the Expedition gained at least ten pounds, including myself. One man gained 45 pounds. He left an office to go down and was mostly skin and bones at the start of the adventure. This is ample proof that worries were not too great, also that we had good food.

Photographic paper gave no trouble. It was not affected by the extreme cold. Film is not affected either, as far as its preservation is concerned. In 1928 some film was left at Little America by Captain Ashley McKinley, of the U. S. Army, a well known photographer and writer. It was Eastman panchromatic mapping film, 18 by 24 centimeters, by 75 feet—each roll, 110 exposures. I found some of this film buried in the snow near his photographic laboratory five years after he left it. I thought it would be interesting to try out, and found that it was as good as fresh film. I used several rolls for mapping trips and it proved to be highly satisfactory. It was by this experiment that I found that panchromatic film was better than super-panchromatic for most of the purposes at Little America. It had softer contrast which was better for the photographing of snow. In the five years that the film had been left in the snow, the surface temperatures ranged from 74 degrees below zero, Fahrenheit, to 20 degrees above zero, and it was in such temperatures as these that the film was preserved. Film that was 30 years old was found in a state of perfect preservation from the Andre Expedition. This film, too, was removed from the snow and developed. The pictures printed satisfactorily. I am convinced that film can be preserved indefinitely in freezing temperatures.

In this respect we were saved the troubles experienced by explorers in tropical countries where the high temperatures and humidity work havoc with the gelatine.

In accounts to follow I shall tell of outdoor shots, aerial shots, the difficulties of developing film, the advantages of the triple convertible lens, and describe my photographic laboratory.

END

Our Readers

(*Continued from page* 45)

tails, but we have picked one out for ourselves from the photos.

The wing-strut construction is such that the wings part in the center and can be folded back along the side of the fuselage for transport to the field. This is a great convenience and is well worth the attention of our home builders.

From what we can decipher on the photo, the struts are hinged both on the wings and at the fuselage so that the strut comes flat up against the wing and folds back with it along the fuselage. Apparently, it is not necessary to disconnect any of the members except the two halves of the wings above the fuselage.

END

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Lightplanes

(*Continued from page* 19)

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130 h.p. "Gipsy Major" Engine

Maximum Speed	150 m.p.h.
Cruising Speed	130 m.p.h.
Range	660 miles
Landing Speed	42 m.p.h.
Take-off Run	90 yds.
Climb	1300 ft./min.
Service Ceiling	18,000 ft.
Empty Weight	1210 lbs.
Loaded Weight	1900 lbs.
Span	34 ft.
Area	172 sq. ft.
Length	24 ft.
Height	6 ft. 8 in.

END

Zeppelins

(*Continued from page* 32)

from one place to another. We had received warning that the "Zepps" were about. Consequently we were on the alert, ready dressed in case of emergency, when all at once the bombs began to fall. They seemed to be about ten miles away, when suddenly the whole town was flooded with light. Indeed, one could have read a newspaper, such a brilliant light it was.

The fifteen searchlights which surrounded the town were on and we could quite distinctly see the "Zepp" floating about in the sky. It was the first time I had seen one, although they had been visiting us for three years. There were also one or two airplanes hovering near it, but whether ours or the enemy's, I do not know.

Amid the sound of guns and bombs, the "Zepp" broke in two, burst into flame, and fell gracefully, slowly it seemed, to the earth. It seemed like a long pencil on fire, the flames soaring up the sides until it gradually got bigger and bigger as it reached the ground, one mass of burning framework. Immediately we realized what was happening we started cheering. All our fear was forgotten; we were so excited—laughing, crying, singing and cheering!

But the burning Germans were not forgotten. When the "Zepp" was falling through the air on fire, a lady who stood watching said suddenly, "Oh, those poor men!" and thereupon fainted. We pitied them afterwards when the excitement had died down and we thought of the horrible death they had suffered. They, too, belonged to "someone," and had died doing what they thought was their duty.

END

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THE NEW SENSATIONAL SELLEY-TEX **"MOTH"**

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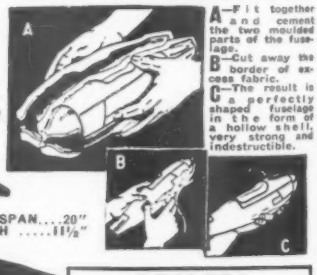

A—Fit together and cement the two moulded parts of the fuselage.
B—Cut away the border of excess fabric.
C—The result is a perfectly shaped fuselage in the form of a hollow shell, very strong and indestructible.

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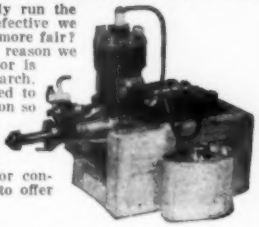

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The G.H.Q. Motor is priced especially low so that you may deal direct with our factory. Even though dealers have asked to handle this product, we have not been able to give them a special dealer's price. This famous motor, complete, entirely assembled on stand, tested and run before shipment, performance guaranteed. No oil, gas or batteries included. Postpaid for only $12.50. Free—one finished fly-wheel mounted on motor with every finished motor..... **$12.50**

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Here is your opportunity to obtain a kit of this famous motor. Assemble it easily yourself and save money. Everything is in the kit including plug, coil, condenser, tank, ignition wire, cylinder, piston, connecting rod, timer, crank-shaft, all screws, nuts, bolts, etc. No oil, gas, batteries, or propeller included. Postpaid for only..... **$8.50**

STANDARD WARRANTY

"We warrant each new G.H.Q. gasoline engine manufactured by us, to be free from defects in material and workmanship under normal use and service, our obligation under this warranty being limited to making good at our factory, any part or parts thereof, which shall, within ten (10) days after delivery of such motor to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction, to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on our part, and we neither assume nor authorize any other person to assume for us any other liability in connection with the sale of our G.H.Q. gasoline engine."

G.H.Q. SCORES AGAIN!

With this reprint of an editorial from April issue of Modern Mechanix

Gasoline powered airplane models are finding great favor with aviation fans and a $3 prize was awarded to Francis Kosanda, of Hopkins, Minn., for his interesting letter:

Francis Kosanda, of Hopkins, Minn., holds gasoline powered model he and Robert Apgar constructed. On its initial flight, the 9-foot model flew out of sight but was recovered again.

Hopkins, Minn.

Dear Editor:

Enclosed is a photo of a gas powered model airplane built by Robert Apgar, of Minneapolis, and myself. It is of original design and powered with a G.H.Q. motor.

The model weighs five and one-half pounds, has a wing span of nine feet, and an aspect ratio of 8-1. On a test flight the model went out of sight after ten minutes, but was later recovered from a tree overhanging the Mississippi River.

Your articles on gas engines, gas models, and model airplanes are excellent. **Francis Kosanda.**

Judging from the report, the gas model must be an excellent cloud chaser and we are glad it was recovered without serious damage.

G. H. Q. SPORTSTER KIT

The G.H.Q. Sportster kit especially designed for G.H.Q. Gasoline Motor but may be used for any other motor of like weight and power. Built according to scientific aero-dynamic principles—Has made hundreds of successful flights without crackup—Marvelous glider . . . And what a climber!

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These are the giant models that have amazed the model builders of America. Imagine strong outdoor flyers that are actually one-third the size of passenger carrying planes—a $10 value for only $1.00. Everything is in the kit including all liquids—nothing else to buy!

CONTENTS: Each of these new G.H.Q. Giant 5 ft. Model Planes contains full-size Plans, all ribs, formers and curved parts clearly printed on best grade Balsa. Large bottles Cement and Dope, different colors Japanese Tissue, Special Endurance Rubber, finished Ready-Cut 3" Wheels, Wire, Balsa strips cut to size, Washers, and . . . Movable Controls, shock-proof Landing Gear, Scale Details, Lettering, Numbering and Insignias, Flight Log, etc.

5 ft. Monocoupe, also 5 ft. Heath Parasol and 5 ft. Stinson Reliant.

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Control Systems

(*Continued from page 42*)

length depending on the angle they make with the periphery of the lever arc.

To facilitate the calculation of the linear motion, suitable for estimating purposes, a chart is given in Sec. 4, with arcs indicating the length of the lever in inches, and vertical lines for reading the linear displacement of the pin connection in inches.

For example: if the length of the lever is six inches and the movement 20 degrees from the vertical, the horizontal motion will be two inches; but if the movement is from 20 to 40 degrees then the movement will only be 1¾ inches. A layout with enlarged dimensions will give the correct relative position of the levers as well as their angular and linear motions.

Controls are usually placed on a torque tube, laid longitudinally or laterally with the main axis of the airplane. Sec. 5 to Sec. 9, Sec. 11 and Sec. 12 show diverse designs of control units. Wheels, usually used in large airplanes, are from 12 to 16 inches in diameter and often with partly removed rim to allow unobstructed view of the instrument board.

To prevent chafing of cables on the rim of pulleys, the pulleys are fastened to the structure, and the cables acting through the center line of the torque tube. (Sec. 6.) In some design the control stick is operated by a wheel (Sec. 12), which will add unnecessary weight and friction to the unit.

Designing aileron control will have added difficulties if tried to enclose the whole controls within the wing, especially within wing of small dimensions. The conventional aileron control gives the up-aileron and the down-aileron the same angular motion; but they do not have the same rolling moment (Sec. 13).

To equalize some of the differences the differential aileron is used which gives the up-aileron greater angular motion than the down-aileron. This difference of motion may be accomplished by a bell crank of less than 90 degrees, as shown in Sec. 14. It can also be accomplished by making the radial lines of the levers not parallel and using push rods.

Push rods are subject to vibration and have excessive weights if of great lengths; to use guides would only add friction. By splitting the rod into shorter lengths and placing the connections on a swinging lever-walking beam—any distance can be bridged and the weight of the unit reduced. (Sec. 10.)

Butt welds on push rods are permitted if reinforced by a sleeve, bolt or rivet. (Sec. 16.) Often the connection of the cable is too close to the pulley; which would result in a slackening of the cable during operation of the control; this may be eliminated by using a quadrant (Sec. 15).

All rudders are controlled by foot pedals, stirrups or rudder bars. The difference between pedal and stirrup is the location of their respective bearings. (Sec. 17.) Cramped conditions beneath the floor board or designing the rudder controls after building the fuselage usually result in a conglomeration of levers and pulleys.

Pulleys to have guards and their bearing pressure or the bearing pressure of any other joints subject to angular motion should be 20 per cent of the ultimate bearing strength of the softest material. When using ball bearings the manufacturer's rating should not be exceeded.

At this point it should be noted that all ball-bearings or roller bearings should be provided with dust-proof caps that will prevent the entrance of grit or dirt into the races. Likewise, means should be adopted for the protection of plain sleeve bearings and also means for lubricating them.

Again, the controls should be so located that no ordinary object can wedge into the spaces or jam the controls. This has special reference to the arrangement in respect to the floor boards and adjacent walls.

The varying height of the pilots requires adjustable seats, adjustable foot plates or foot bars (Sec. 21 and Sec. 22). Fins are usually set at a certain angle to offset the spiral motion of the slip stream or to offset other unbalanced forces. For close adjustment tabs are used to be locked with the rudder or tabs operated with the rudder; the later ones enable the designer to keep the rudder forces the same during the total angular motion.

There are other controls used in airplane to operate flaps, slots spoilers (baffle flaps) or controls to change the curvature of the wing, or to vary the area of the wing always adding more mechanical details to the design; they should be designed with the minimum of friction, with the minimum of joints and weight, using push rods, and ball bearings; they should be machined with a close tolerance and inspected with the latest instruments to insure equal quality and thus safety in the air.

END.

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1 oz. 5c
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20x30", 1 for 9c
2 for 17c
Reed
1/32, 1/16"
.....3 ft. 1c
.....3 for 2c
Wooden Wheels
½", pair..2c
¾", pair..3c
1", pair..4c
1½", pair..4c
1¾", pair..7c
Celluloid Wheels
¾", pair... 5c
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Balsa Balloon Wheels
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28" Span. Length 20½". Weight 4 oz. 1" Scale

THE MOST EXCLUSIVE AND FINEST EQUIPPED MODEL IN THE WORLD
A special De Luxe model, one of the most beautiful and finely detailed ever made, with its special exact scale 3⅝" celluloid, 1200 H.P. type, Wright Cyclone motor, having aluminum push rods, cylinder fins, etc., like real motor. Also in set are 4" aluminum cowl ring, 9" carved spruce semi-scale flying propeller, colored star and rudder insignia, 2" celluloid balloon wheels, silver dope, paint, black, red striping, Navy lettering, wire parts formed, axles, rubber motor, windshield, instrument board, flying wires, 4 aluminum step plates, aluminum wing walks, ready cut wheel pants, etc. All other parts printed on balsa. Detail scale drawing.
Construction Set complete, postpaid..... **$4.50**
Above model ready to fly, as shown..... **$22.00**

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41" Span. Length 28". Weight 8 oz. 1" Scale

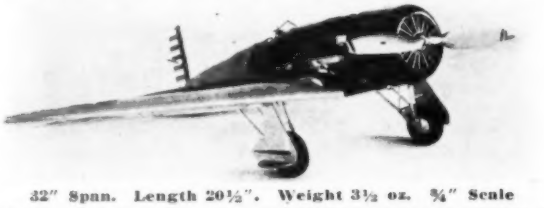
This new model, built very strong yet light in weight, is practically crashproof and will out-perform any large scale model built. Rises from ground in 10 feet and flies over 650 feet. Set contains all parts printed on balsa, ready cut pant cores, 4¼" turned motor front, 11" steel type carved paulownia wood propeller, 2½" balsa wheels, tail wheel, formed wire parts, 26' rubber, 3 oz. yellow dope, 2 oz. blue, ⅛ oz. black, 2 oz. glue, cement covering, full size scale drawing, and all parts.
Construction Set complete, postpaid..... **$4.95**
82" Gas Model Set of above, without motor..... **$25.00**

NEW BOEING P26A ARMY FIGHTER

22" Span. Length 17⅛". Weight 2½ oz. ¾" Scale

Above photo shows finest equipped model of this plane on the market. Having ready made motor, cowl, prop, etc., it is very easy to build and is a beauty. Const. set contains 3" celluloid motor, 3¼" span tapered aluminum cowl ring, 8" steel type paulownia wood prop, 1⅝" celluloid wheels, tail wheel, insignia, windshield, instrument board, 1 oz. yellow dope, 1 oz. blue, cement, glue, all parts printed on balsa, and drawing.
Construction Set in labeled box, postpaid..... **$2.75**
Above model ready to fly, as shown..... **$15.00**

NEW LOCKHEED P24B ARMY FIGHTER



32" Span. Length 20½". Weight 3½ oz. ¾" Scale

New scale special detailed model, equipped with 2" pneumatic rubber tired M. & M. air wheels. Set also includes ready made and painted pilot's bust shown, 2 aluminum step plates, 9" carved steel type prop shown, all parts printed on balsa, turned balsa motor front, 3 oz. colored dopes, paper cement, 2 oz. glue, covering, colored insignia, formed wire parts, nose plug with brass bearing, rubber, 9 metal motor exhaust pipes shown on cowl, full size scale drawing, and all parts to build.
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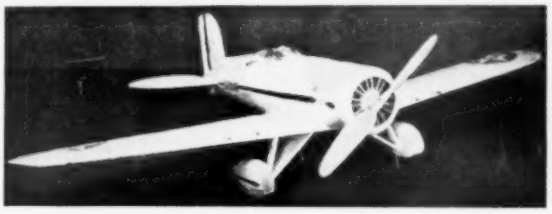


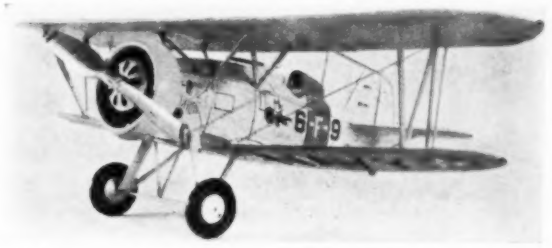
COMBINATION LAND AND SEA PLANE SET

32" Span. Length 20½". Weight 3½ oz. ¾" Scale

New 4-gun Navy fighter. Model will rise from land or water in few feet. Construction set contains fuselage and pontoon formers, wing ribs, tips, etc., printed on balsa, a 3⅜" turned cowl front, 2 instrument boards, colored insignia, lettering, windshields, 9" carved scale flying prop shown, 3 oz. silver paint, 1 oz. cement, ⅛ oz. black, 2 oz. glue, ready cut wheel pants, strong 2" aluminum wheels, 12 feet of rubber, and large 33"x40" drawing of land and sea plane. This is a sensational model and only one of its type in the world.
Construction Set in labeled gift box, postpaid..... **$2.95**
Above model ready to fly, as shown..... **$20.00**

NEW BOEING F4B4 NAVY FIGHTER

New Improved Detailed Model



22½" Span. Length 14½". Weight 2½ oz. Color, Grey, etc.

This is the finest equipped Boeing, F4B4 model in the world. New improved model exclusively equipped with new 3¼" special aluminum streamline tapered cowl ring, 9 cylinder celluloid motor with aluminum ventilator front, 8" carved varnished steel type propeller, printed out balsa wood parts, 2 oz. grey dope, ⅛ oz. yellow, ⅛ oz. red, paper cement, glue, formed wire parts, celluloid wheels, tail wheel, U. S. Navy lettering, colored insignia, and ¾" scale drawing. Construction Set complete, postpaid..... **$2.95**
Above model ready to fly, as shown..... **$18.00**

NEW NORTHROP FT1 NAVY FIGHTER

22" Span. Length 15". Weight 2½ oz. ¾" Scale

A beautiful flying model of the latest Northrop 280 m.p.h. fighter. Set contains 3" turned motor front, 8" carved propeller, insignia, silver, black and clear dope, glue, all parts printed on balsa, full scale drawing, and all parts to build as shown.
Construction Set complete, postpaid..... **$2.00**

NEW

LOCKHEED R20-1 NAVY ATTACK

27½" Span. Weight 3½ oz. Color, Silver, etc. ½" Scale

Model is fully detailed with authentic wing rib and body stringer spacing. Every air-minded boy will want this powerful-looking model. Motor power is run through the fuselage and is concealed—a special exclusive feature.

Set contains 2 standard steel type carved wood propellers, 16' rubber, star and rudder insignia, all parts printed on balsa, 2 turned balsa motor fronts, balsa air wheels, silver dope, black, glue, full size scale drawing, and all parts to build. Construction Set complete, postpaid..... **$2.95**

Note: Orders sent West of Miss. or Foreign, add 20c postage

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MINIATURE AIRCRAFT CORP., 83 Low Terrace, New Brighton, New York

XUM

Geodetic

(*Continued from page* 43)

not capable of taking bending loads. It must be supplemented with spars in the case of a wing, and longerons in the case of a fuselage. These latter members take the bending loads while the geodetic construction gives the necessary torsional rigidity.

The geodetic construction lends itself to either metal or fabric covering, although it is said that with the Vickers' methods of fabric attachment a very good streamlined surface is obtained. Incidentally by this method the fabric is said to be able to stand pressures of nearly 1000 lbs. to the square foot, which is far in excess of any pressures met with at speeds attained at the present time.

Readers will no doubt remember the lattice mast construction at one time very common in ships of the U. S. Navy. It was claimed for this arrangement that many of the geodetics could be shot away and still leave the masts standing. The same applies to the Vickers-Wallis construction, since several of the members can be broken without seriously impairing the strength of the structure.

The advantages of this are obvious in regard to military aircraft damaged by machine gun or anti-aircraft gun fire. One of the problems associated with the design of high A.R. cantilever wings of orthodox construction is that of torsional weakness.

This results in twisting of the wing in flight and hence we get reversal of aileron control with, in most cases serious consequences. Hence the necessity for a new method of construction in which this effect cannot occur.

Figure 5 shows a fuselage employing geodetic construction in place of the usual tie rod bracing. If the number of geodetics be increased as in Figure 6, the bulkheads may be spaced further apart with a consequent saving in weight. Again if the pitch of the geodesics is sufficiently small, the bulkheads may be dispensed with altogether. At present the main drawback appears to be the manufacturing difficulties. Few of the geodesics are alike and thus mass production becomes difficult and costly.

Even in symmetrical fuselage, the most that can be hoped for is four members alike. In spite of this, however, two types of aircraft employing the new construction have been put into quantity production for the Royal Air Force. I refer to the Vickers "Wellesley" Single Engined Medium Bomber, and the "Wellington" Twin Engined Bomber.

END

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PICK YOUR WINNER !

The SILVER FLYER

Span 6 ft. Length 3' 6"
Chord of wing 10"

Our NEW trim single seater pursuit that will give you many enjoyable hours—enjoy building it—enjoy flying it. Complete kit with full size plan, wheels, sheet aluminum, printed out balsa parts, screws, bolts, etc.

Price of kit only ..... $ 5.00
Complete kit with Baby Cyclone Motor 22.25
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The REARWIN Speedster

Span over 6 ft. Length 3' 6"
Chord of wing 10"

This contest winner is a favorite all over the country. Hundreds have built, flown, and are still enjoying it. Complete kit with M & M air wheels, colored dopes, full size plan, screws, bolts, sheet aluminum, and many parts too numerous to mention.

Price for this super kit only ..... $ 7.00
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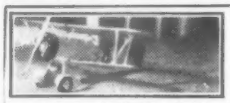

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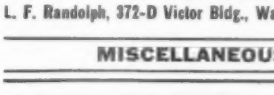

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(*Continued from page 28*)

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